Popular Yoga

PRÂṆÂYÂMA

ॐ

सोऽहम् ।

PRÂṆÂYÂMA

PART ONE

BY

S'RÎMAT KUVALAYÂNANDA

POPULAR YOGA

VOLUME TWO

KAIVALYADHÂMA

LONAVLA (G.I.P.)

BOMBAY-INDIA

1931

Price:

India: *Rs. 2/8*; Continent: *Sh. 6/6*;

America: *$ 1.50.*

PREFACE

मूकं करोति वाचालं पङ्गुं लङ्घयते गिरिम् ।
यत्कृपा तमहं वन्दे परमानन्दमाधवम् ॥

(Reverence to Mâdhava, the Supreme Bliss! Blessed by Him the dumb shall grow eloquent and the lame shall stride across a mountain.)

WHEN we started editing *Yoga-Mîmâñsâ* some seven years back, we never dreamt that it would be so popular with the public. The measure of success attained is exclusively due to the grace of the Lord and to the blessings of our All Merciful Gurudeva. Had it not been for our personal short-comings, the journal would have been much more attractive and instructive too. We are, however, more than satisfied with the work that has already been done and hope to work more zealously at it, as we go on.

The journal *Yoga-Mîmâñsâ* was originally intended to be a magazine for discussing the scientific and therapeutical sides of Yoga. Immediately after its appearance, however, it became amply clear that the journal was being used as a practical guide by students of Yoga all over India. We had to give, therefore, in great detail and with utmost accuracy the technique of the different exercises treated in *Yoga-Mîmâñsâ*. This plan has succeeded so well that our magazine is looked upon as the most authoritative text-book on practical Yoga.

The pre-publication and the post-publication prices of *Yoga-Mîmâṅsâ* are by no means heavy when the great cost entailed in bringing out such a publication is taken into account. But owing to the very low purchasing power of an average Indian, these prices become prohibitive for those whose interest is mainly centred in the practices of Yoga and who have either no wish or capacity to go into the scientific theories and researches published in that journal. These prices become the more prohibitive when a particular subject is not completed in one volume, but extends over two or three of them. Besides each volume of *Yoga-Mîmâṅsâ* anticipates a knowledge of the proceding volumes. These circumstances make the prices still more prohibitive.

To avoid this difficulty and to bring authoritative textbooks on practical Yoga within the reach of everyone interested in the subject, we have planned this series of *Popular Yoga*. It will appear in several volumes, each of which will be complete in itself. The present handbook is the first part of the second volume of this series, and is devoted to the practical study of *Prâṇâyâma*. Ujjâyî and Bhastrikâ are the two types of Prâṇâyâma discussed here. The second part of this volume will consider the remaining six types out of the eight varieties of Prâṇâyâma mentioned by Svâtmârâma Sûri in *Haṭha-Pradîpikâ*. The first volume of this series, the first part of which is already in press, gives detailed instructions in *Âsanas*. It will be published in a couple of months. Thereafter the remaining Yogic processes will be taken up, group by group, and will be discussed in detail from the practical point of view in different volumes of this series,

PREFACE

Although this series is intended for the practical students of Yoga, we do want every reader of it to understand the *science* of the different practices discussed herein. The experimental evidence upon which the physiological theories of the different practices are based and the theoretical details, need not detain a practical student of Yoga. It is, however, essential that the anatomy and physiology of every point in the technique of the exercises is clearly grasped even by those students of Yoga who have only a practical interest in its study. Hence in the present handbook we have first given a note on the anatomy and physiology of respiration in general. Thereafter we have described the technique of Ujjâyî, Kapâlabhâti and Bhastrikâ in such a way that all the anatomical parts involved in these practices have been clearly indicated, and the physiological aspects of every anatomical movement have been emphasized. Thus a student who picks up Prâṇâyâma by reading this handbook or a student who first takes practical lessons from a Yogic expert and then reads this handbook, will not be doing blindly his Pranayamic exercises but will be able to follow very intelligently the details of his Prâṇâyâma from the anatomical and physiological points of view.

The general discussion on the subject of Prâṇâyâma as it is presented to us by the Yogic seers of the past, is also of immense value for an intelligent understanding of the Pranayamic exercises. Such a discussion is also included in this handbook.

The glossary very tersely gives anatomical and physiological information which has been detailed in *Yoga-Mîmâṅsâ*.

It will, however, serve as a valuable guide to a practical student of Yoga and will make him independent of any text-book of anatomy and physiology.

Two important appendices have been attached to the handbook. The general hints contained therein have been based upon our clinical experience at the Âśrama. The insertion of these appendices in this handbook, is intended to make it thoroughly useful to the practical students of Yoga.

As usual we have very richly illustrated the subject that is under discussion in this handbook. Every effort is made to make the handbook thoroughly instructive as well as interesting

Cautions have been pronounced at every step, making the text-book a reliable and safe guide for a practical student of Prâṇâyâma. In spite of this fact we would strongly advise everyone first to get himself trained under an expert, if possible and then take up this handbook for guidance.

We wish to draw our readers' attention to a very important consideration. The *Popular Yoga* series is no substitute of *Yoga-Mimâṁsâ*. Whoever wishes to understand Yoga from the modern point of view and cares to learn thoroughly and intelligently the anatomy and physiology of different Yogic exercises, must study *Yoga-Mîmâṅsâ*. The mass of scientific information that is published in that journal is so valuable and yet so concisely given, that to abbreviate it has become an impossible task. So the different chapters of the present handbook do not summarize the information given in the original magazine. Many of them are merely reprints of the

different articles that have appeared in *Yoga-Mîmâṅsâ*. The chapter on the physiological and spiritual values of Prâṇâyâma had to be made so shallow in its treatment that no scientific mind would be satisfied with it. There was no help. To go deeper into the subject was to repeat whatever was said in hundreds of pages of the original magazine. As this could not be done for the limited scope of the present handbook, the subject had to be cursorily and superficially treated. We, therefore, request our readers not to be satisfied with the information they would get from this handbook; but to approach *Yoga-Mîmâṅsâ* for getting a thorough knowledge of Pranayamic exercises.

The handbook has been priced at Rs. 2/8/-. When we take into consideration the volume of the handbook, the quality of the paper used, the number of illustrations given and many other features of it, too numerous to be enumerated here, this price should not be found heavy. Compared with similar literature available in the market, the price that we have fixed upon, will surely be considered reasonable.

A word may be said here about the cover. We have purposely used paper cover. We have taken care to make it durable. Those of our readers who wish to have a better quality of it, should individually spend on that item. We did not wish to burden our readers with the additional cost which would be incurred in providing them with a superior type of cover.

The literary and scientific work that is being conducted in the Âśrama has become possible principally for the liberal

patronage we are getting from His Highness the Maharaja Ranasaheb Bahadur of Porbandar. It is only, therefore, in the fitness of things that we should have thought of dedicating this handbook to His Highness. We applied for his consent. And His Highness has very graciously given the same to us. In doing this the Maharajasaheb has only conferred an additional obligation upon the Âśrama. We very respectfully offer our thanks to His Highness for this very gracious act of his.

Our editorial work and its publication would have never become possible had it not been for the affectionate co-operation of our brother Ashramites. To thank them for having done their duty to the Âśrama is to insult them, because they are doing their duty so selflessly. They do not wish even to be thanked for the service they are rendering to humanity in general and to the Âśrama in particular.

No publication is successful without a hearty co-operation of the press. We are happy to note that Mr. Y. K. Padval, the managing proprietor of the Tatva-Vivechaka Press, is offering us the best co-operation and deserves our hearty thanks for the same. The quality of work he gives us is always befitting the high reputation that his press enjoys.

We are quite conscious of the drawbacks from which our publications are suffering. Up to now we have been very indulgently treated by the readers of our journal. We crave the same indulgence from the readers of this handbook. Looking to the fact that the proceeds of all our publications go to support the Âśrama, it would not be too much to expect

that our publications are far more liberally patronized than they are patronized at present. The more liberal the patronage, the better equipped we shall be for the service of humanity.

With these few words we present this first handbook of *Popular Yoga* to our readers and request them to receive it with the warmth which the subject discussed herein deserves.

Praṇavakun'ja,
Borivli, B.B. & C.I.,
Balipratipadâ, 1853.

KUVALAYÂNANDA

To

His Highness

Maharana Shri Sir Natavarsinhaji Bahadur, K. C. S. I.

Maharaja Rana Saheb of Porbandar

WITH HIS GRACIOUS CONSENT

THE AUTHOR DEDICATES THIS BOOK

In Admiration for his Enlightened Interest in
the Art and Science of Yoga and in
Gratitude for his Liberal
Patronage to the
Ashrama.

His Highness
Maharana Shri Sir Natavarsinhaji Bahadur, K. C. S. I,
Maharaja Rana Saheb of Porbandar

CONTENTS

PAGE

PREFACE v

DEDICATION xii

CHAPTER

I. Respiration 1

II. Asanas Appropriate to Prâṇâyâma ... 30

III. Prâṇâyâma in General 45

IV. Ujjâyî 67

V. Kapâlabhâti 79

VI. Bhastrikâ 101

VII. Physiological and Spiritual Values of Prâṇâyâma 116

APPENDICES

I A Full Course in Yogic Physical Culture for an Average Man of Health ... 129

II A Short Course in Yogic Physical Culture 138

GLOSSARY 141

LIST OF ILLUSTRATIONS

FIG.		FACING PAGE
1	Median Section through the Head Indicating the Respiratory Tract, etc.	3
2	Face with the Mobile Nose Cut off and the Nasal Bones and Cavities, with the Upper Jaw-Bone exposed	4
3	The Pharynx Exposed	9
4	The Vocal Cords	12
5	The Trachea and the Bronchial Tubes ...	12
6	The Thorax Exposed	16
7	The Ribs	20
8	Nâsâgra-Drishṭi or the Nasal Gaze	30
9	Bhrûmadhya-Dṛishṭi or the Frontal Gaze ...	31
10	Uḍḍiyâna in Sitting	32
11	Uḍḍiyâna in Standing	32
12	Uḍḍiyâna in Sitting (*Side View*)	33
13	Jâlandhara-Bandha or the Chin-Lock (*Front View*)	34
14	Jâlandhara-Bandha or the Chin Lock (*Side View*)	34
15	Preparation for Padmâsana	36
16	Padmâsana or the Lotus Pose	37
17	Preparation for Siddhâsana	38
18	Siddhâsana or the Accomplished Pose ...	39
19	Preparation for Svastikâsana	40
20	Svastikâsana or the Auspicious Pose	41

21 Preparation for Samâsana 43
22 Samâsana or the Symmetrical Pose 43
23 Correct Standing Position for Ujjâyî ... 63
24 Jn'âna-Mudrâ or the Symbol of Knowledge ... 64
25 Preparation for Closing the Nostrils 68
26 Ugly Contortions of the Face 68
27 The Right Nostril Closed 69
28 The Left Nostril Closed 69
29 Both the Nostrils Closed 69
30 Both the Nostrils Open 69
31 Starting Inhalation with Controlled Abdominal Muscles (*Front View*) 70
32 Starting Inhalation with Controlled Abdominal Muscles (*Side View*) 70
33 Full Inhalation with Controlled Abdominal Muscles (*Front View*) 70
34 Full Inhalation with Controlled Abdominal Muscles (*Side View*) 71
35 Full Inhalation with Protracted Abdomen (*Front View*) 71
36 Full Inhalation with Protracted Abdomen (*Side View*) 71
37 Full Exhalation (*Front View*) 74
38 Full Exhalation (*Side View*) 74
39 Abdomen and Thorax at the End of Pûraka in Kapâlabhâti 87
40 Abdomen and Thorax at the End of Rechaka in Kapâlabhâti 87

PRÂṆÂYÂMA

CHAPTER I

RESPIRATION

PRÂṆÂYÂMA is a Yogic exercise in respiration. It is therefore desirable that a student of Prâṇâyâma is acquainted with some important details of the respiratory system. Hence we propose to describe in this chapter a few broad features of the anatomy and physiology of respiration.

Respiration consists of the alternate expansion and contraction of the thorax, by means of which air is drawn into or expelled from the lungs. In this chapter we shall first consider the various organs that are directly concerned with this passage of air to and from the lungs; and then we shall see how these organs act in the different stages of respiration.

The organs of respiration may be enumerated as the nose, the pharynx, the larynx, the trachea, the bronchi and the lungs. Nerves and blood-vessels connected with these parts may also be looked upon as organs of respiration. Generally, however, the nose is not included in such an enumeration. But when we want to write on respiration from the Yogic point of view, the nose has not only to be included but to be studied in detail. In dealing with these organs we shall proceed along the passage of the air from outside into the lungs and as we meet with the nose first, we shall start this chapter with a description of that organ.

THE NOSE—We shall be able to study the nose both externally and internally with the help of a mirror and of the charts given in this chapter. In using his mirror the reader should allow light to come from his back and fall upon the mirror held in his front. The mirror should be so adjusted as would easily throw reflected light into the nostrils when the head is thrown backward, but would not dazzle the eye.

We always see our nose in the mirror. But what we generally see is only the external part of the nostrils. Let our reader have a peep into the internal portions of the nostrils also. He will find that by the side of the dividing wall, up in the cavity there is a hole in each of the two nostrils. He might think that these holes are a sort of communication between the nose and some other organ situated inside the head. But he would be seriously wrong in thinking that way. In fact the external nose is only a small part of the organ known as the nose. The most important part of it is situated inside the head, behind the two holes our reader has seen, and above the hard palate that forms a part of the roof of his mouth. We shall presently examine this internal part of the nose. But before we do so let us finish with the external part of that organ.

If we feel our nose with our fingers, we find that a very large part of it is mobile. This is because this portion of the nose, including the dividing septum, is made of different cartilages attached to one another by a tough fibrous membrane and covered over by the skin. If our reader again looks into his mirror and examines the inside of his nostrils, he will find that the skin which covers the external surface of the nose, continues inward and also covers the lower chamber

a *b*

FIG. 1.—Median Section through the Head Indicating the Respiratory Tract, etc.

1 Base of the Brain 2 Tract of the Olfactory Nerves 3 Bulb of the Olfactory Nerves 4 Branches of the Olfactory Nerves 5 The Septum of the Nose 6 Bony Folds of the Nose 7 Eustachian Tube 8 The Hard Palate 9 The Soft Palate 10 Mobile Part of the Nose

of the internal nose. He will find even the lower portion of the septum clothed similarly in skin. This portion of the nasal cavity is called the *vestibule*. (Vide Fig. 1). From the walls of this vestibule, our reader will find, a number of stout and stiff hairs projecting. Out of these hairs, those that grow from the front part project backward, whereas those that rise from the back part project forward. Thus a sieve-like arrangement is provided just at the entrance of the nose. The external nose has two ends. The upper end which is connected with the forehead is called the *root* and the lower end which is free is called the *apex* of the nose.

If we again feel the flexible part of our nose and examine the upper and posterior borders of it, we find them hard. This is because the elastic part of the nose is attached to bones at the top and behind. In Fig. 2 the mobile nose has been removed and bones to which it is attached are exposed to our view. Our reader will immediately see that the bony borders which carried the flexible attachments of the nose, represent a picture exactly similar to that of the heart drawn in the playing-cards. Let us observe a few facts about this bony aperture that directly concern us. Below the forehead and between the eyes there are two bones which we can feel externally. They are called the *nasal bones* (*1*) and form what is known as the bridge of the nose. A vertical line (*3*) is seen dividing the aperture into two exact halves. This represents the nasal septum. The circular curves at the bottom belong to the two upper jaw-bones (*5*). These curves mark the lower borders of the two holes observed by our reader in the back part of his external nose.

We have already stated that the external nose is only a small part of the real organ. The most important part of it

is situated inside the head. We have now removed the mobile nose and come to the entrance of the inner cavities. Let us now note what is there inside the aperture that lies before us in Fig. 2.

The aperture which is divided into two halves by the nasal septum leads to two cavities that are roughly speaking oval-shaped. These cavities continue backward and open into the throat with holes similar to those we observe on the bony surface before us. Each of these cavities has a floor, a roof, and a medial and a lateral wall.

The septum which divides these cavities stands for the medial wall of both. It is made of bones all along except in front where a large cartilage fills up the gap. The floor is also bony. A reference to Fig. 1*a* will show this floor in a median section. It is made of two bones. The front part is made of the upper jaw-bone and the back part, of the hard palate. If we feel the roof of our mouth with our finger from the upper teeth backward, we will meet with two hard surfaces One is rough and the other is smooth. The rough surface which we feel just above our teeth is the upper jaw-bone in which the teeth are set. The hard but smooth surface that we cross when the finger is moved backward belongs to the hard palate bone. Behind this the soft palate can easily be felt. Fig. 1 shows that the upper surfaces of the two bones are horizontal and that is why the floor of the nasal cavities is horizontal also. So the upper jaw-bone and the hard palate at once form the roof of the mouth and the floor of the nose. That means the nasal cavities lie just above the roof of the mouth. The lateral walls of the nasal cavities are somewhat complicated. They are also made of bones. They rise from

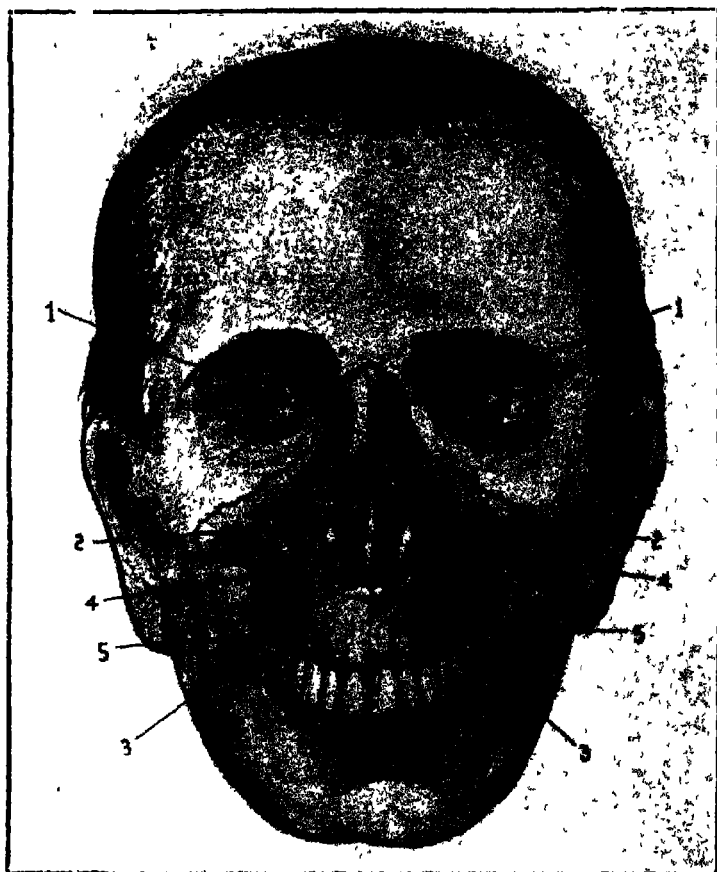



Fig 2 — Face with the Mobile Nose Cut off and the Nasal Bones and Cavities, with the Upper Jaw-Bone Exposed.

1 The Nasal Bones. 2 The Nasal Cavities. 3 The Nasal Septum. 4 Scroll like Bones 5 The Upper Jaw-Bone.

below at some distance from the septum, but as they rise they incline towards the septum to meet it at the roof. Some idea of this inclination of the lateral walls can be had from Fig. 2. Here the bony aperture represents the external borders of these nasal walls. So these cavities are broad below, but narrow down at the top. From the lateral walls arise inside the cavities scroll-like bones. One of them has been marked in Fig. 2 (*4*). These scroll-like bones extend all along the length of the lateral walls and open backward into the throat. Now we consider the roof. This is also a bony structure. The floor of the nasal cavities is horizontal; but the roof is arched. An idea of this arch can be had from Fig. 1*b*, where the septum is shown arching at the top. Now this septum rises direct to meet the roof, and therefore the upper curve of the septum fairly represents the arch of the roof. We may note especially two bones that form the roof. The nasal bones that have already been noticed form the front slope of the arching roof. Behind these nasal bones the roof is formed by a big bone called the *ethmoid*. The ethmoid is at once the roof of the nose and a part of the floor of the brain. That means it separates the nasal cavities from the brain. Thus the nasal cavities stand between the mouth and the brain; and open backwards into the throat just above the soft palate.

Up to now we have studied the bony structure of the external nose as well as the nasal cavities. Now we have to note that these hard surfaces are covered over with mucous membrane. This mucous membrane is a continuous piece that lines not only the inside of the external nose except the vestibule, but it also clothes the floor, the roof and the walls of the nasal cavities and continues into the pharynx. When we

examine this mucous membrane covering the nasal cavities, we find that functionally two areas are to be mapped out. The upper area covers one-third of the total surface of the nasal cavities and the lower area the remaining two-thirds. Having the sense of smell situated in it, the upper district is called the *olfactory region*, the lower district being called the *respiratory region*, as it constitutes the passage of air breathed in and out during respiration. That means the cavities of the nose have got two separate tracts for the two functions they perform. If we divide the height of the nostrils into three equal parts, the uppermost part is used for smelling and two lower parts are used for breathing. None should suppose, however, that the uppermost part is not at all available as a passage for respiration. Although in the normal and quiet breathing only the lower two parts are used, in forced breathing the upper third is also utilized. The sense of smell, however, is confined to the upper third only, having nothing to do with the two lower regions. This is because the sense of smell depends upon the presence of the olfactory nerve endings which are distributed only over the upper third area.

Two features which distinguish the mucous membrane covering the olfactory region from that covering the respiratory tract, deserve our attention here. The mucous membrane which clothes the respiratory tract is thick and spongy whereas that which lines the olfactory region is softer and more delicate. The other distinguishing feature is the very great vascularity of the respiratory tract. In fact it is marked by the presence of a rich venous plexus. These anatomical facts have a physiological significance. As noted above in ordinary quiet breathing, the air moves through the lower two-thirds of the

nasal area. The air in the upper one-third is scarcely disturbed. Now that portion of mucous membrane which lines the passage of the air must be stouter than the portion where the air is stationary during the hours of normal breathing. The greater vascularity of the respiratory tract has also a purpose to serve. When external air is to be breathed into the lungs, it must be warm and moist, otherwise it may have an injurious effect upon the delicate structure of the lungs. Now the large supply of venous blood which is present in the plexus situated in the respiratory region, raises the temperature of the air being inspired and also moistens it.

It has been stated above that the sense of smell is situated in the upper one-third of the nasal cavities. This sense consists of very fine nerve filaments from twelve to twenty in number. They are distributed like a thick brush both on the septum and the lateral walls. Here these nerves descend through the ethmoid bone which, as we have seen above, separates the nasal cavities from the brain. Through the ethmoid the olfactory nerves are connected with the olfactory bulb which in its turn is joined to the base of the brain through the olfactory tract. Fig. 1 illustrates the olfactory nerves, the bulb, the tract as also the base of the brain. When the fine endings of the olfactory nerves are stimulated by particles carrying odour with them, sensation of smell is experienced.

Following facts may be remembered with advantage in regard to the sense of smell.

The delicacy of the sense of smell is very remarkable. It has been calculated that even $\frac{3}{1,000,000,000}$ of a grain of musk can be distinctly smelt.

But when the particles issuing from an odoriferous substance are very few, their presence in the air may not be appreciated in normal breathing. Because they pass through the respiratory passage only and are not presented to the nerve endings in the olfactory region. If under such circumstances a sudden sniff is made, air is forced even into the olfactory tract and the faint odour can be detected.

Even a liberal proportion of odoriferous particles in the air may fail making itself felt. For the sense of smell to be excited, the mucous membrane must be neither too dry nor too moist. So when one catches cold his sense of smell is dulled owing to the presence of excessive moisture. There is another reason also why one does not smell properly during cold. The swelling of the mucous membrane covers the nerve filaments rendering them inaccessible to the odoriferous particles.

It is a matter of common experience that perfumes make the strongest impression to start with. Afterwards they grow fainter and even their presence is lost upon us, if we continue long to be in their presence. This circumstance can be accounted for by the fatigue of the sense of smell. The olfactory apparatus is soon exhausted and fails us on that account. If, however, we take a round in the fresh air, the apparatus is refreshed and we can again appreciate odours.

THE PHARYNX— It has been stated above that the nasal chambers posteriorly open into the throat. These openings are situated above the soft palate and below the base of the cranium. This portion marks the beginning of the pharynx. Now if our reader again looks into the mirror with his mouth widely opened, he will observe that there is something like a

FIG. 3.—The Pharynx Exposed.

(The Tongue is shown below and to the right of the Soft Palate)

1 Orifice of the Auditory Tube. 2 Nasal Part of the Pharynx 3 The Soft Palate 4 Oral Part of the Pharynx. 5 The Epiglottis. 6 Laryngeal Part of the Pharynx. 7 Cricoid Cartilage 8 The Œsophagus. 9 Thyroid Cartilage. 10 The Larynx. 11 Cricoid Cartilage 12 The Trachea.

wall of flesh covered over with the mucous membrane, stretching behind the tongue and the soft palate. This wall arches above the soft palate in something like a dome. It is exactly under this dome that the posterior openings of the nose are located. Below the tongue the wall descends in the form of a sack that ends in two openings, one of which leads to the œsophagus and the other to the larnyx. (Vide Fig. 3). From the backward openings of the nasal chambers to the lower openings leading to the œsophagus and the larynx, the same canal stretches continuously and is known as the *pharynx*. Our reader need not be told that the mouth is only an opening in the anterior wall of the pharynx. So up to now we have noticed five openings of the pharynx, two nasal, one oral, one œsophageal and one laryngeal. There are two more orifices which pierce the pharynx. They are situated in the side walls of the pharynx, one on each side, above the soft palate. They are called *Eustachian orifices*, because they mark the openings of the Eustachian tubes which run to the cavities of the ears. The portion of the pharynx that is situated above the soft palate is called the *nasal part* of the pharynx, that situated behind the mouth and the tongue is called the *oral part*, whereas the remaining portion is called the *laryngeal part*.

The pharynx is used for the passage of the air as it is breathed in and breathed out. In inhalation the air drawn through the nasal cavities passes across the nasal and oral parts of the pharynx and then getting down the larynx goes into the trachea and the lungs. In exhalation the air expelled from the lungs follows the reverse path. At the time of breathing the œsophagus as well as the Eustachian tubes

remain closed and the possibility of the air going a wrong way is avoided. Again the soft palate leaves, between it and and the back wall of the pharynx, an opening sufficient for a free movement of the flowing air. Hence there is no obstruction in the way of respiration.

At the time of speaking, however, the soft palate completely covers the upper part of the pharynx, so that no air can find its way upward into the nasal part. But in some persons, the soft palate is defective, there being a small cleft in it. When these people attempt speaking, some of the air from the lungs escapes through this cleft above the palate ; and finding its way through the nasal passages that are ever open, adds nasalized element to their voice.

Our reader knows that he uses a part of the pharynx also for swallowing. Food travels through the oral part into the laryngeal pharynx and then gets into the œsophagus. The question is why food going down the pharynx does not run into the larynx and is always pushed down the œsophagus. For this purpose we have to refer to a small organ named *epiglottis*.

The epiglottis is situated at the root of the tongue (vide Fig. 3), and serves as a cover for the larynx in times of need. In the act of swallowing, the larynx is raised, and the descending morsel lowers the epiglottis which meeting the raised larynx completely covers its mouth. Thus the larynx being closed, food finds its way to the œsophagus or gullet. The rising of the larynx can be felt by anybody by placing his fingers on the middle of his throat and imitating the act of swallowing. If, however, through mistake, even a small particle of food gets the wrong way, we mean gets into the larynx, violent coughing ensues, the system forcibly trying to expel the intruder. Food

does not get into the nasal part, because the soft palate completely shuts out that portion during the act of swallowing.

The mucous membrane covering the nose is continuous with the pharynx. It is also to be noted that it continues to cover all the passages leading from the pharynx. It is this circumstance which makes a trouble starting with the throat very often spread to the nose, the ear and the larynx. That is why running of the nose, deafness of the ear and coughing, are on many occasions seen going together.

THE LARYNX— We have noted above that the pharynx has two passages opening from its lower end. They are the œsophagus and the *larynx*. Both the œsophagus and the larynx pass through the neck, the former is situated in the posterior part of it, whereas the latter is situated in the anterior portion. The larynx begins in front of the third cervical vertebra and extends across the fourth, fifth and sixth. The œsophagus starts in front of the sixth cervical. Hence it will be clear that the larynx stands higher up in the neck than the œsophagus. (Vide Fig. 3). As the œsophagus remains constantly closed except at the time of swallowing, the air coming down the pharynx gets into the larynx which is always open for this purpose, being closed only during the act of swallowing.

We have already seen that the larynx is situated in the front portion of the neck. It is a box-like anatomical structure made of different cartilages, and measures less than two inches. Two of these cartilages can be felt even from outside the throat. Starting from the jugular notch upward and feeling the surface of the throat with our fingers, we meet with the first prominence at a short distance. This is the cricoid cartilage. (Vide Fig. 3). Travelling further up we come across

the next prominence, visibly projecting especially in the case of thin persons. This is the thyroid cartilage, the prominence being popularly known as *Adam's apple*. These and other cartilages including the epiglottis which is also a cartilage, are held together by muscles which move them according to the needs of the situation. We have already learnt how the larynx is raised and the epiglottis lowered, during the act of swallowing. As soon as the swallowing is over the larynx is lowered, and the epiglottis raised, leaving the passage free for the air moving to and fro during respiration.

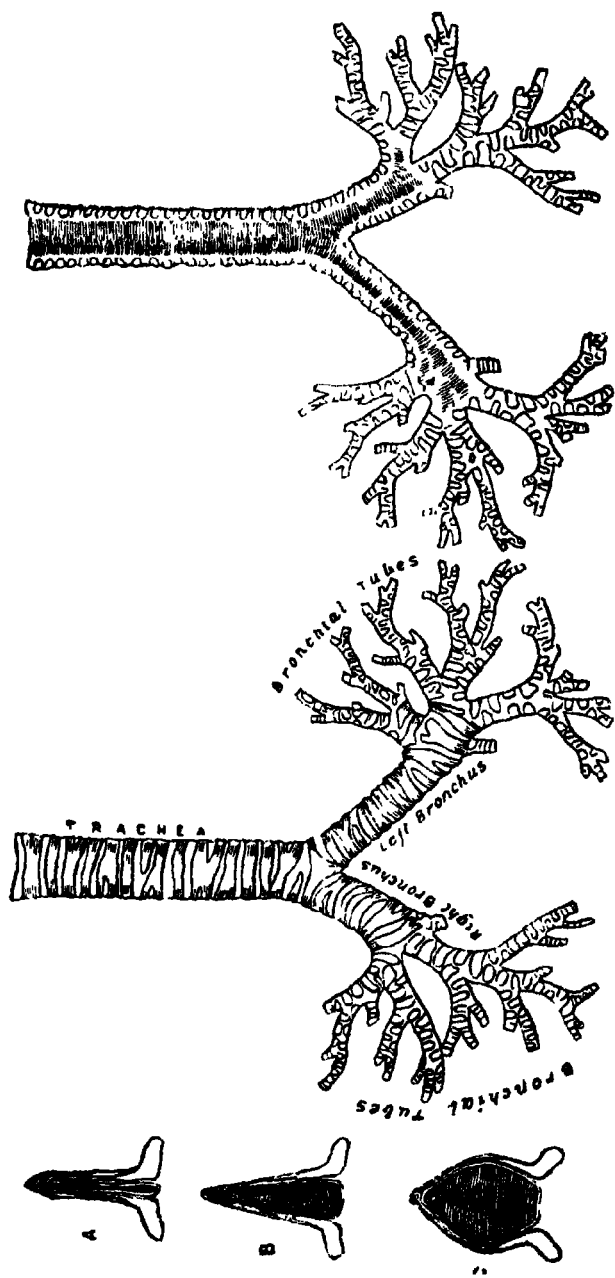
The larynx is popularly known as the voice-box. We want to see now how this box-like instrument is responsible for human voice. Like the pharynx the larynx is covered with mucous membrane on its inner surface, the mucous membrane that covers the pharynx continuing to cover the larynx also. This mucous membrane is thrown into several folds. Two of these start from the front of the box midway in its height, and stretching across its cavity, join the opposite side. These folds are very thin. They are joined together in the front, but are capable of being separated from behind. These folds are situated just behind the thyroid cartilage already referred to. *A* in Fig. 4 represents these folds as they stand close together and *C* as they stand wide apart, *B* illustrating the middling position. The three figures indicate the appearance of the folds that they would present to a man peeping into the larynx from above. These folds admit of being brought so tightly together, that they can completely shut up the air below even at a high pressure. These folds are capable of undergoing different degrees of approximation. During normal respiration they stand apart and the passage of the air

4.—The Vocal Cords.

FIG 5 —The Trachea and the Bronchial Tubes

is smooth and noiseless. But when they are brought close together the air passing through the narrow chink formed by them, throws them into vibrations which in their turn throw the passing air into ripples. It is this rippling air that produces the sound when it strikes our ear. Thus being responsible for the human voice these folds are called *true vocal cords*, the narrow chink between them being called the *glottis*. These vocal cords are called *true* because they are to be distinguished from another pair of similar folds situated just above them, which are called *false vocal cords*, because they are not concerned in the production of voice.

The mucous membrane which forms the true vocal cords by forming itself into two thin bands, continues to cover the lower portion of the larynx and extends into the trachea into which the larynx opens.

THE TRACHEA— The trachea or the windpipe is a tube-like anatomical structure some four inches in length. It starts at the bottom of the larynx from behind the cricoid cartilage and extends down into the chest just behind the breastbone. In thin persons the upper part of the trachea may be felt with our fingers below the cricoid cartilage. The diameter of the trachea is something like an inch.

The tube of the trachea is formed by cartilaginous rings, from sixteen to twenty in number, which are arranged one above the other, and which are held together by an elastic fibrous membrane in which they are enclosed. These rings are not entire but are deficient in part. They are arranged in such a way that the circular part is placed in front and deficient part is placed behind. Of course the deficient part of the tube is covered by the fibrous membrane which clothes the

whole trachea. Fig. 5*a* represents the appearance of the trachea as seen from the front and Fig. 5*b* illustrates the appearance of the same as seen from behind.

It has been stated above that the œsophagus is placed just behind the trachea. In fact the membranous part of the trachea and the œsophagus run together. Hence any obstruction in the œsophagus produces a sense of suffocation, although the air passage is free.

A large number of mucous glands is situated in the mucous membrane of the inner surface of the trachea. Under normal conditions the mucous secreted by these glands keeps the passage moist. But if there be an excessive secretion of mucous, it is ejected immediately. The inner mucous membrane of the trachea is lined with ciliated epithelium.[1] These cilia always maintain an upward movement and thus slowly sweep up the secretions towards the larynx from which they are ultimately coughed out.

THE BRONCHIAL TUBES— The trachea when it descends into the chest to the level of the fifth thoracic vertebra, is divided into two tubes called the *bronchi*. The tube on the left side enters the left lung and is known as the *left bronchus*, that on the right side entering the right lung being called the *right bronchus*. (Vide Fig. 5). After entering into the substance of the lungs, each bronchus divides itself into several branches, these branches again dividing themselves into smaller tubes. These divisions and subdivisions continue to penetrate the substance of the lungs through and through, till at

1 Epithelium is the delicate tissue forming the outer layer of the mucous membrane. Cilia are very minute hair-like vibrating organs on the surface of the epithelium, forming there a sort of brush.

last the tubes become so small that their diameter hardly measures $\frac{1}{40}$th of an inch. The trachea with the two bronchi and the numerous smaller and still smaller branches spreading out from them would, if they are separated from the lungs, present the appearance of an inverted tree with the main stalk pointing upward. (Vide Fig. 5). When the tubes are reduced to $\frac{1}{40}$th of an inch in diameter, they stop subdividing themselves any more. Here the fine bronchial tubes widen themselves and then end in finer air-cells having a diameter of $\frac{1}{50}$th of an inch only. A bunch of grapes can very well give a graphic idea of the minute bronchial tubes with air-cells clustering roundabout them. When the air that comes through the nostrils, the pharynx, the larynx, the trachea and the bronchial tubes successively, reaches the air-cells, its further passage is stopped. From these cells it is diffused into the blood. But before we study this diffusion, we shall note a few important points about these bronchial tubes.

We have seen above that the trachea is made up of cartilaginous rings. Similar cartilaginous portions are present throughout the bronchial tubes except in the last finest branches. The presence of these portions is absolutely necessary for keeping the tubes constantly open for the passage of the air to and from the lungs. Otherwise the tubes would have been exposed to the danger of a collapse.

The fibrous tissue that holds the cartilaginous portions together throughout the length of the bronchial tubes, is very elastic. This circumstance helps the tubes to adopt themselves to the movements of the surrounding anatomical parts.

As in the trachea so in the bronchial tubes, the inner mucous membrane is lined with ciliated epithelium. The mucous

glands imbedded in the mucous membrane, keep the air passages moist under healthy circumstances. But in disease when the secretion is excessive, the bronchial tubes stand in the danger of being blocked up. Here the cilia try to help the situation. By their perpetual upward movement they work up the secretion up to the larynx. This organ is immediately irritated and throws out the secretion by a cough.

THE LUNGS— In the previous section we have referred to the air-cells. These air-cells are matted together by means of fibrous tissues. Blood-vessels running through these cells divide and subdivide themselves into myriads of capillaries covering these air-cells. Again there is a network of nerves spreading throughout these structures. All these parts, the cells, the blood-vessels and the nerves form themselves into two masses of a spongy substance each of which is called a *lung*. We shall now study these statements in a greater detail.

Alveoli is another name for the air-cells. All the alveoli developing themselves roundabout a fine bronchial tube, presenting the appearance of a bunch of grapes, go to form what is called an *ultimate lobule*. Several ultimate lobules constitute a *lobule* and several such lobules are contained in a *lobe*. The right lung has three such lobes and the left has two. (Vide Fig. 6)

The walls of the air-cells which cluster round the finest bronchial tubes, are made of very elastic and circular muscular tissue. The walls are, however, extremely thin, so much so that the air which flows into the cells through the air tubes, is very freely diffused through these walls, although its direct passage is blocked up here.

We have referred to the myriads of capillaries that cover the air-cells. These are the finest ultimate subdivisions of the

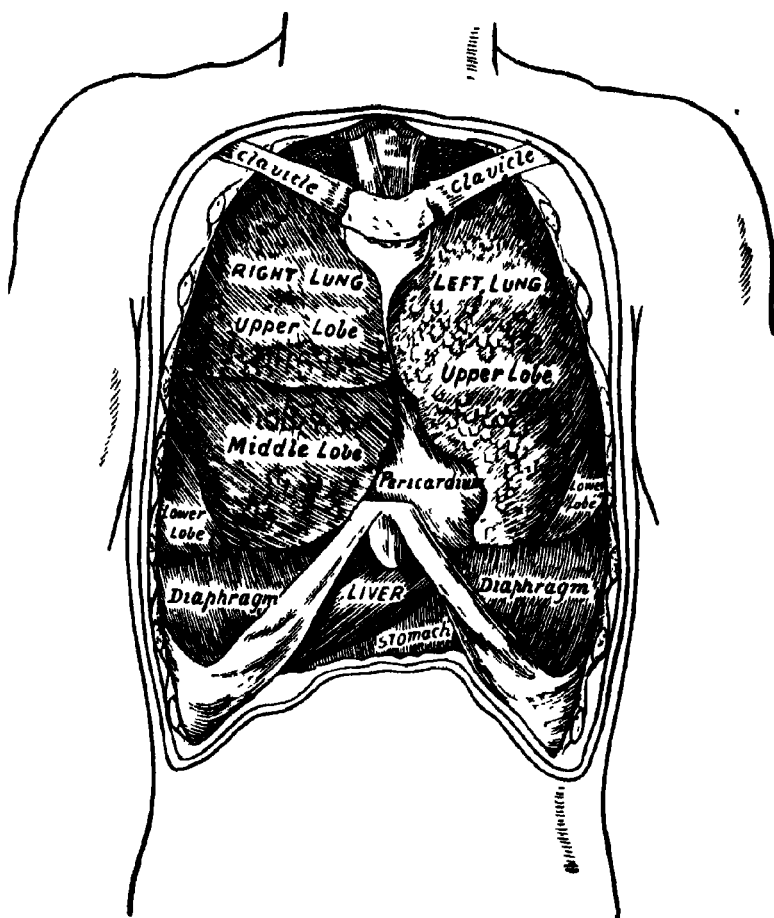



FIG. 6.—The Thorax Exposed.

blood-vessels coming into the lungs and going away from them. The incoming vessels bring impure blood from the heart, to be purified in the lungs. The *outgoing vessels carry the purified* blood from the lungs back to the heart. Now the network of the capillaries which covers the air-cells is extremely fine, and the walls of the capillaries are extraordinarily thin. So when we consider an air-cell, we find that inside the cell there is a stock of fresh air which is surrounded by two extremely thin layers of tissues, the first belonging to the cell and the second pertaining to the capillaries. Beyond these layers is the blood streaming through the capillaries in very very fine currents. The two intervening layers, even when put together, are again so thin, that they allow a free interchange between the oxygen from the cells and the carbon dioxide from the capillaries.

The number of blood capillaries which surround the air-cells is so large that it passes all imagination. It is calculated that these capillaries from the two lungs would connect Bombay with London, if they were stretched out in one single line ! We can, however, understand the necessity of this huge length of capillaries, when we know the amount of blood that is presented through them to the air-cells for purification. If the quantity of blood present in the lungs at a particular moment, is spread out in a very thin layer, it would cover as many as one thousand square feet at least ! So we find that the arrangement of the air-cells and the capillaries, is to secure a very large surface area for the lungs, within such small limits as the chest of a human being.

This description of the lungs would not be complete unless we explain the two coverings in which the lungs are

clothed and which form air-tight bags for holding them. These coverings are called the *pleuræ* and consist of a serous membrane, that is, a smooth glistening membrane that secrets a lubricating fluid. Each lung has a separate pleura of its own, which is folded double, so that the two layers cover the lung completely. Thus an air-tight double bag, having two sheaths one inside the other, of serous membrane is prepared, and each lung is held within this bag. Our reader knows that the lungs are placed inside the thorax. Now the outer layer of the pleura lines the inner surface of the thoracic cavity, and is called the *parietal layer*. The inner layer is adherent to the lungs, and is called the *visceral layer*.

A tolerably good idea of the relations of the lungs, pleuræ and the thorax can be had, if we compare these with a football. The coarse leather bag which forms the outer covering of a football, very well illustrates the rough thorax. Inside this leather cover there is the rubber bag which when the ball is to be used is kept inflated. Now instead of one bladder let us suppose that there are two, one inside the other. When air is pumped into these bags they will swell up. In this inflated condition the outer bag will adhere to the rough leather covering in which these bags are held, and the inner bag will lie closely along the outer rubber bag. The two layers of the pleura lie exactly like the two rubber bags in relation to each other. The only difference is that in the case of the pleural layers there will always be a sort of lubricating fluid secreted by the membrane that allows the two layers to glide smoothly on each other during the constant movements of respiration. Again in the case of the football, the inside is hollow, whereas in the case of the pleural layers, the inside is filled with the

spongy substance of the lungs. Needless to point out that the tube of the rubber bags through which air is pumped in, may fitly illustrate the trachea.

The space between the two layers of the pleuræ is called the *pleural cavity.* Under normal conditions of health, the two layers stand so close together, that there is no space left between them. But during inflammatory changes of the membrane, as in pleurisy, the cavity becomes enlarged by an increase in the amount of fluid which it contains.

We have said above that the lungs are held in the thorax But the lungs are not the only organs situated there. Besides these there are the heart, the big blood-vessels, the trachea and the œsophagus. These are placed between the two pleuræ, the right and the left, the cavity in which they are arranged being called the *mediastinal cavity.*

The lungs are short in front and longer behind. In front they descend to the sixth ribs whereas behind they stretch up to the eleventh ribs. This position of the lungs is determined by the position of the diaphragm which forms the floor of the thorax. It is to be remembered that above they rise even a little beyond the clavicles. On an average the right lung weighs 22 ounces in an adult, and the left weighs 20 ounces only.

Thus far we have noticed the different organs through which the air moves, when it passes to and from the lungs during respiration. Now we shall consider the muscular and nervous mechanisms responsible for the movements of these organs of respiration, and shall also study the blood-vessels connected with this function.

THE MUSCULAR MECHANISM[1]

"The force expended in opening the chest in inspiration each day is enough to raise the person the height[2] of St. Paul's, and is thus only about one-sixth of the force spent in the circulation. Breathing consists of two acts—*inspiration* and *expiration*. *Inspiration* is a *forced muscular effort* performed by *three* distinct sets of muscles—those that act on the ribs, those that act between the ribs, and the diaphragm, which is the floor of the thorax.

"In inspiration the *chest cavity* is made[3] broader, longer and deeper. When at rest, the ribs, hinged behind to the backbone and in front to the breastbone, hang down like the iron handle on the side of a bucket. (Vide Fig. 7). Now, if we raise such a handle, it not only moves upward, but outward. The same takes place with the ribs ; and, in addition, the sternum, or breastbone, being movable, rises forward as well, and thus the chest is made *broader* and *deeper*. It is made *longer* because, when at rest, the diaphragm muscle forms an arched floor, that rises like a dome into the thorax, and on which the lungs rest. As this muscle contracts it flattens[4] the floor, pulls the lungs down, and as a result makes them longer from top to bottom.

"The muscles that raise the ribs are in two sets—those

---

1 In this note, paragraphs included in the quotation marks are extracted from *A. T Schofield's Articles on Physiology*.

2 Five hundred feet

3 Increased in the three diameters—lateral, vertical and antero-posterior.

4 As has been proved in *Yoga-Mîmâṅsâ* by means of experimental evidence, and as is now held by the medical scientists, the diaphragm does not flatten during contraction, but descends parallel to itself without altering its convexity. Even then the descent of the diaphragm does increase the vertical diameter of the lungs.

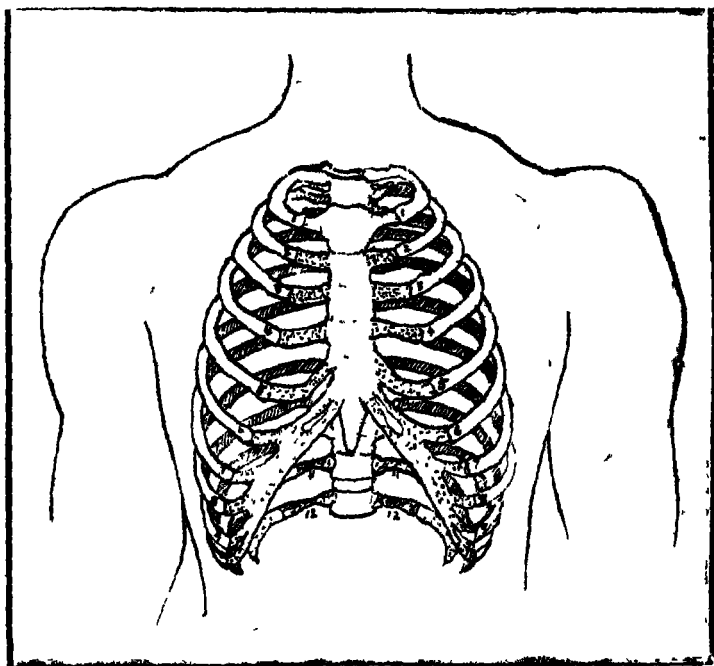



Fig. 7.—The Ribs.

(The Cartilages have been marked with dots)

that act on the ribs and those that act between them. The upper ribs are pulled upward by the action of muscles passing down from the neck.

"Between each rib is a double layer of muscles called the intercostal muscles, because they are between the ribs. The top ribs being fixed as these contract, they tend to raise the lower rib, to which they are attached; and thus, by acting together, all the ribs are elevated.

"This constitutes the movement of inspiration.

"In expiration, *the chest returns to its original size* without effort. This is mainly caused by *elastic recoil.* The lungs are full of elastic tissue, which is stretched when the lungs are expanded; and, as soon as muscular effort ceases, the elastic force is so great that the lungs pull the ribs down again, and pull up the floor of the diaphragm.

"When we draw in a breath the abdomen swells out. This is caused by the contraction of the diaphragm, which presses all the digestive organs down and makes them bulge out the walls. In expiration the abdomen gets flat again, as the floor rises once more, and the abdominal muscles are contracted.

"The force required to stretch out the elastic tissue in ordinary inspiration is equal to 170 lb.; and the total daily force used in respiration is 21 foot-tons.[1]"

In extraordinary or forced breathing the force required for the act is much more than in normal respiration. Both in

1 Force required to raise one ton of weight through twenty-one feet against gravity, or to raise twenty-one tons of weight through one foot against gravity.

inhalation and exhalation additional muscles are brought into play. The additional muscles which are called into action in forced expiration are situated in the neck and chest. In forced expiration the abdominal muscles play a very important part.

It is to be especially borne in mind that speaking, singing, blowing etc., are voluntary expiratory efforts, whereas sneezing, coughing etc., are involuntary. In all these actions the abdominal muscles are brought specially into action.

When one holds his breath after deep inhalation all the muscles of inspiration remain contracted and the glottis is tightly closed. So also it remains tightly closed when one holds his breath after deep exhalation. At this time, however, it is the muscles of expiration that maintain their full contraction.

It is to be noted here that the air outside freely communicates with the lungs when the glottis is open. We have seen above that the glottis remains closed only at the time of swallowing. So during all the twenty-four hours of the day, the air outside communicates freely with the lungs. Now this outside air always stands at an atmospheric pressure, and if it gets communication with a space that stands at a lower pressure, it will flow to that space till the pressures outside that space and inside it become equalized. This is exactly what happens at the time of inspiration. When the lungs become broader, deeper and longer owing to the opening up of the chest, the pressure inside the lungs is lowered and the outside air rushes in through the trachea till internal pressure becomes equal to that of the atmosphere. This constitutes the act of inspiration.

It has been stated in the foregoing paragraphs that in inspiration the ribs are elevated and the diaphragm sinks, pressing the abdominal viscera, thus leading to the bulging out of the abdomen. When the whole muscular mechanism of respiration is healthy, the rising of the ribs and the bulging out of the abdomen are proportionate. But in case of defective respiratory mechanism, either the abdominal movement or the costal movement is more prominent than the other. This circumstance has led to a distinction in the types of breathing. That respiration in which the costal movement is prominent, is called *costal breathing*. Again the breathing in which the abdominal movement is more in evidence, is called *abdominal breathing* or *diaphragmatic breathing*. The latter breathing bears a double name because the abdominal movements depend upon the movements of the diaphragm.

Due to old age or disease the chest becomes rigid. Under these circumstances the breathing becomes abdominal. People very often, due to their peculiarities of dress, make the movement of the abdomen almost impossible. If this habit is continued over a long time, breathing becomes costal rather than abdominal. Owing to these reasons it is desirable that the whole mechanism of respiration is allowed the greatest scope for movement.

When the chest begins to sink, the pressure inside the lungs is increased and becomes greater than the pressure outside it. Hence air is driven out of the lungs through the trachea, till at last the elastic recoil is completed and again the internal and external pressures are equalized. This constitutes the act of expiration.

Whatever the amount of air inside the lungs either during inspiration or expiration, that air exerts an equal pressure on

each of the lungs as a whole; and keeps it, under all conditions, closely in contact with the walls and the floor of the chest.

The number of respirations under normal conditions is between fourteen and twenty per minute.

Having noted the muscular mechanism of respiration, we now proceed to study the nervous mechanism of it.

THE NERVOUS MECHANISM

"The nervous mechanism of respiration is of great practical interest. There are two great centres in the brain where respiration is controlled—the one is the conscious region, under the control of the will, and hence, of course, voluntary; the other is the unconscious region, which is involuntary, and governed in its action by the unconscious mind. The movement of the muscles is controlled from those centres by various nerves, notably the pneumogastric nerve.[1]

"Practically our breathing is under our own control up to the point where life is involved. We can breathe in any manner and at any rate we please. Were it not so, speaking would become impossible. We can also hold our breath up to a certain point; but when life is beginning to be threatened the other involuntary centre comes into play, and, in spite of the strongest effort of will, forces us to breathe. This control also acts continuously when we are not thinking of our breath at all. None of the vital processes require our constant attention; yet with some we are allowed to play up to the point of danger, but no farther."

We shall refer to this nervous mechanism again at the end of this chapter.

---

1 The vagus nerve. The pulmonary plexuses are formed by branches of the vagus and sympathetic.

THE QUANTITY OF AIR WE BREATHE

The quantity of air we breathe depends upon the depth of respiration. In the ordinary normal respiration, the quantity of air that uniformly flows in is about 500 c.c., that is a little more than 30 cubic inches. As much air also flows out during normal expiration. Thus the volume of the tide of air that constantly and uniformly flows in and flows out is about 500 c.c. This is called *tidal air.*

But if the inspiration were to be deeper, it is obvious that a larger quantity of air will be drawn in. It is estimated that about 1600 c.c. of additional air can be drawn in by an average adult in the deepest inspiration. This additional quantity is called *complemental air.*

Again an average adult can expel about 1600 c.c. of air by a forcible deep expiration over and above the 500 c.c. which he expels in his normal exhalation. This additional air expelled by a forcible deep expiration is called *reserve* or *supplemental air.*

It is to be noted, however, that even the deepest expiration will not be able to empty the air-cells completely. There will always be a residue of air left in the lungs. This residue is calculated to be equal to 1600 c.c. and is called *residual air.* So we see that in a violent expiratory attempt preceded by the deepest possible inspiration, an adult will breathe out the following quantities:—

Complemental Air	1600 c.c.
Tidal Air	500 c.c.
Supplemental Air	1600 c.c.
Total—	3700 c.c.

Such a quantity is taken to indicate the *respiratory* or *vital capacity* of man. When we add to this the 1600 c.c. of the *residual air*, we get what is called the *lung capacity* of an individual. Both the vital capacity and the lung capacity are found to vary according to the height and weight of an individual.

Up to now we have seen how we breathe and also how much we breathe. Now we will see why we breathe at all.

WHY WE BREATHE

A solution of this problem is available in the comparison of the quality of the air we breathe in and the quality of the air we breathe out. The following is the composition[1] of the two types of air :—

	PER HUNDRED PARTS		
	Nitrogen	Oxygen	Carbon Dioxide
Inspired Air	79	20·96	0·04
Expired Air	79	16·02	4·38
		4·94	4·34

Here we at once find that the expired air has lost 4·94 parts of oxygen and has gained 4·34 parts of carbon dioxide in going into and coming out of the lungs. Where has this oxygen gone and whence has this carbon dioxide come? Oxygen has been taken up by the stream of blood that circulates through the lung capillaries and carbon dioxide has been substituted for it by the same agency.

If we bring together two vessels containing two different gases without any partition between them, the two gases will

1 Only those constituents that are important from the physiological standpoint have been compared here.

mix up very thoroughly. This very thing happens even if the two gases were to be separated by a thin partition of a membrane. Now we know that the blood streaming through the capillaries around the air-cells and the air in the air-cells, are separated only by a thin partition consisting of the walls of the capillaries and the air-cells. So the gases of the air and the blood mix up very freely. This is what is called the diffusion of gases. In the figures quoted above for comparison, we find that the quantity of oxygen substituted for carbon dioxide, is greater than the quantity of carbon dioxide by 0·60. This is because oxygen is used not only in forming carbon dioxide, but also for some other physiological work.

Now we proceed to see why the circulating blood current in the lung capillaries, wants to borrow oxygen and tries to lose carbon dioxide.

In this connection we are to remember that the human body is constantly at work even when apparently it is at rest. The circulatory system, the respiratory system, the digestive system etc., know no rest. They have to work ceaselessly. This perpetual work means constant wear and tear of the body tissues involved in the work. So the loss of the tissues is to be made good ; and waste products are to be removed and thrown out of the body. Now for making good the loss, nourishment has to be brought to these tissues. This nourishment consists not only of food and drink, but also of oxygen. Why, oxygen forms the most important factor of nourishment. We cannot live without oxygen even for a few minutes. So the blood when it comes to the lungs, borrows oxygen from the inspired air and carries it to the different parts of the body through the circulatory system. Again the blood when it comes to the lungs is full of

carbon dioxide collected from the tissues all over the body. It is a waste product resulting from the working of the bodily machine. If this gas is allowed to remain in the system, it would poison the body in a short time. Hence it has to be got rid of. The inspired air is poorer in carbon dioxide. Hence it is willing to borrow the same from the blood and take it away with expiration.

We now understand why we breathe. We breathe in order to absorb oxygen and to throw away carbon dioxide, both the processes being absolutely essential for the life of a human being.

The venous blood when it absorbs oxygen and gets rid of carbon dioxide, is said to be *arterialized*. Venous blood is first collected in the heart and thence is pushed into the lungs. There it is arterialized and again sent back to the heart to be distributed to the different parts of the body and to be returned again to the heart as venous blood.[1]

The venous blood is purple because of carbon dioxide and the arterialized blood is bright scarlet because of its oxygen. This can be proved by experimentation. If a quantity of the venous blood is put into a bottle containing oxygen and shaken, it will turn bright scarlet. On the contrary if the arterial blood is put into a bottle containing carbon dioxide and shaken, it will turn purple.

We undertook to revert to the nervous mechanism of respiration at the end of this chapter. What we now want to say is this.

---

1 For details of the circulatory system, readers are referred to our note on that system given in *Yoga-Mimâṁsâ*, Vol I. It appears there under the heading 'A Few Facts About the Blood and Blood Circulation'.

The quantity of oxygen and of carbon dioxide present in the blood, has been discovered to have great influence upon the respiratory centre. If the quantity of carbon dioxide present in the blood goes beyond its normal measure, the respiratory centre at once becomes more active; and respirations become rapid. This is best seen when a man is taking hard muscular exercise. On the contrary the centre is calmed down if the quantity of oxygen present in the blood exceeds its normal measure with the result that respiration becomes slower than usual.[1]

---

1 In this discussion we have very nearly followed the physiological theories of the Western scientists It is possible to throw a flood of new light on many points concerning the respiratory system, by subjecting Prâṇâyâma exercises to laboratory tests Our present equipment both in science apparatus and subjects is so poor, that we will not be able to make *much* headway, unless we are far more favourably placed in regard to these assets If we are given full opportunities for this type of experimental work, we feel sure that the Yogic science will be able to make very valuable contributions to modern physiology. This is not to be taken to mean that we are not making any progress at all. What we want to convey is this. Our present research work is very very limited. The field for research is vast and our present resources are comparatively poor.

CHAPTER II

ÂSANAS APPROPRIATE TO PRÂṆÂYÂMA

[*Note*— Two Dṛishṭis and three Bandhas are a part of the technique of the meditative poses. We begin this chapter with a description of these Dṛishṭis and Bandhas, with a view to enable our readers to follow the technique of the Âsanas without any interruption.]

NÂSÂGRA-DRISHṬI OR THE NASAL GAZE

FIXING one's eyes upon one's tip of the nose is called Nâsâgra-Drishṭi in Sanskṛita. Nâsâgra means the *tip of the nose* and Dṛishṭi means *gaze*. It is illustrated in Fig. 8. It may be practised as a part of Padmâsana[1] or independent of it. In the accompanying picture, the head is a little thrown back with a view to make the position of the eyeballs visible.

The Nasal Gaze is a fine exercise for the wandering mind. Its practice if undertaken with zest and carried over a period of some months continuously, has a perceptibly beneficial effect upon the unsteady mind.

Caution— The Nasal Gaze directly works upon the brain through the optic nerves. Everybody should, therefore, develop this gaze very slowly and cautiously. Persons with weak nerves are warned not to undertake this practice except under expert supervision.

---

1 Described later on in this chapter

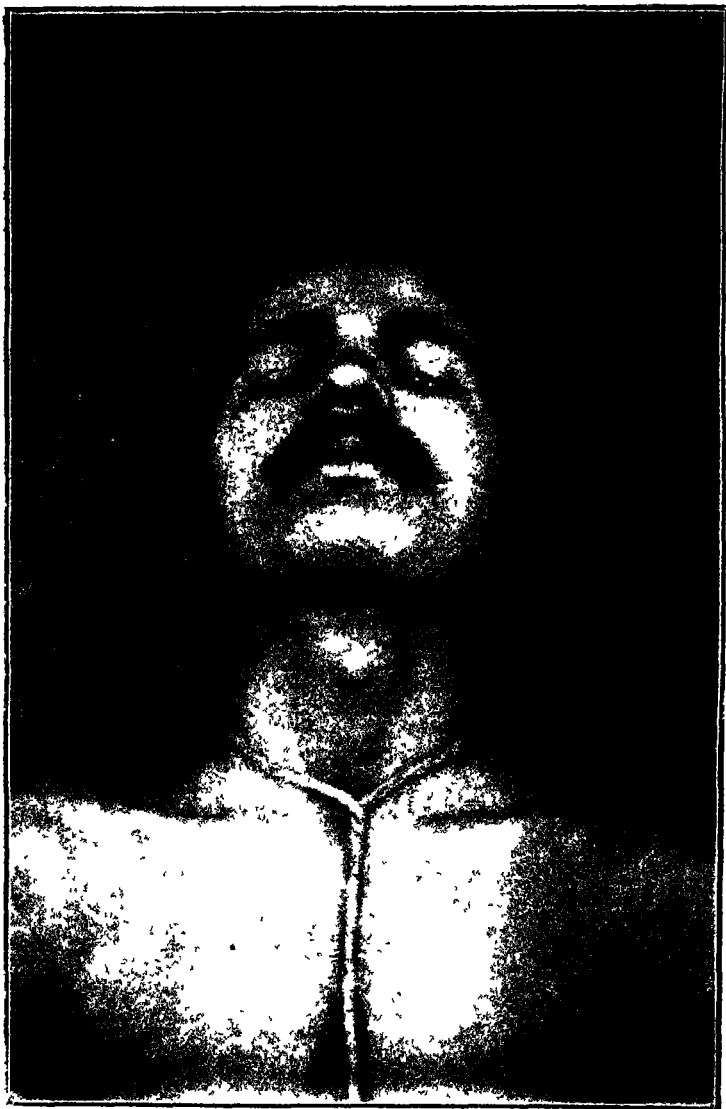



Fig. 8.— Nâsâgra-Drishti or the Nasal Gaze.

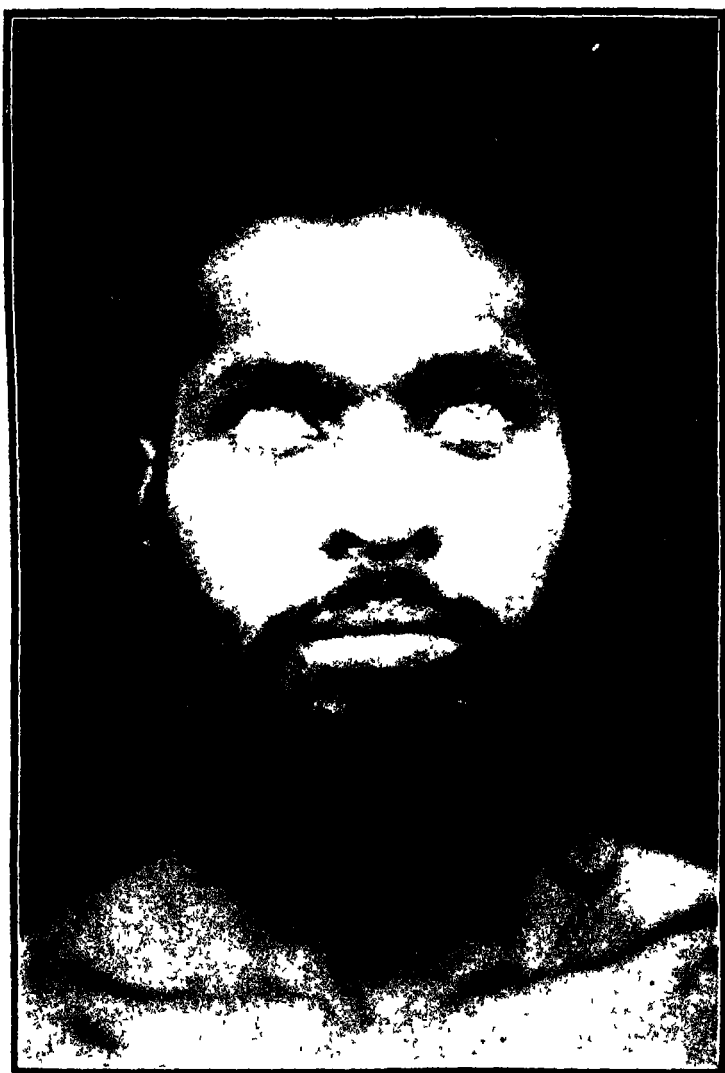



Fig. 9 — Bhrûmadhya-Drishti or the Frontal Gaze.

BHRÛMADHYA-DṚISHṬI OR THE FRONTAL GAZE

Fixing one's eyes between the eyebrows is called Bhrûmadhya-Dṛishṭi in Saṅskṛita. Bhrûmadhya means the *space between the eyebrows.* It is illustrated in Fig. 9. It may be practised as a part of Siddhâsana[1] or independent of it.

Like the Nasal Gaze, the Frontal Gaze is a fine exercise for the mind. But the advice and caution given in the case of the former are equally applicable to the case of the latter. Hence they should be carefully borne in mind by the enthusiastic student of Yoga.

1 Described later on in this chapter.

UḌḌIYÂNA-BANDHA OR THE RAISING OF THE DIAPHRAGM

Uḍḍiyâna is an exercise of the diaphragm and the ribs. When expressed in a popular[1] language its technique may be described as follows.

As this Bandha is practised either in sitting or in standing, the student poses himself as shown in Figs. 10 and 11 respectively. In these pictures, hands are shown to be resting either on the knees or on the thighs. This position of the hands enables them to be firmly pressed against their support and thus to fix up the muscles of the neck and the shoulders. Having taken this posture the student secures the deepest possible expiration by vigorously contracting the front muscles of the abdomen. The chest also stands contracted. While the breath is held out, the muscles of the neck and the shoulders are fixed up by firmly pressing the hands either against the knees or against the thighs as the case may be. Then a vigorous mock inhalation is attempted by raising the ribs and by not allowing the air to flow into the lungs. Simultaneously the front abdominal muscles are completely relaxed.

The fixing up of the neck and shoulders, the vigorous mock inhalation preceded by the deepest possible exhalation, and the simultaneous relaxation of the contracted front abdominal muscles, these three actions complete the technique of

1 This Bandha has been subjected by us to a very large number of X-ray and other experiments. Hence we are in a position to give a detailed scientific description of its technique. Looking to the popular character of this publication, however, we have sketched its technique in the simplest terms possible

FIG. 10. Uḍḍiyâna in Sitting.

FIG. 11.—Uḍḍiyāna in Standing

FIG. 12 — Uḍḍiyāna in Sitting (*Side View*).

Uḍḍiyâna. Automatically[1] the diaphragm will rise up and the abdomen will undergo a pronounced depression, producing the concave appearance shown in Figs. 10, 11 and 12. A slight forward bent of the trunk will be helpful in securing greater abdominal concavity. This position is required to be maintained throughout the exercise of Uḍḍiyâna.

When the student finds that he can no longer hold his breath out comfortably, he relaxes his neck and shoulders, lets go the ribs and slowly starts inhalation, allowing the abdominal depression to be effaced gradually. When inhalation is completed, one round of the Uḍḍiyâna exercise is finished

Uḍḍiyâna means *rising up* and Bandha means *contraction of particular anatomical parts*. This exercise is called Uḍḍiyâna-Bandha because the muscular contractions described above enable the spiritual force[2] to rise up. Anatomically this Bandha may be called Uḍḍiyâna because it raises the diaphragm.

Uḍḍiyâna is a very fine exercise for the abdomen. Its therapeutical value against constipation, dyspepsia, liver troubles etc., is very great. Its spiritual worth is greater still. All the same, people suffering from circulatory or serious abdominal troubles should take to this exercise with caution.

---

1 The pressure changes in the chest and abdomen which are responsible for this automatic abdominal depression, have been detailed in *Yoga-Mimâṅsâ* in places too numerous to be quoted here We very strongly recommend our readers to approach the journal, if they wish to have an intelligent grasp of the technique of Uḍḍiyâna

2 This force is locked up in the lower region of the abdomen Uḍḍiyâna is one of the different exercises capable of letting loose this force and making it to travel upward along the spine.

JÂLANDHARA-BANDHA OR THE CHIN-LOCK

Jâlandhara-Bandha requires the chin to be closely pressed against the chest. For doing this the chin is to be tightly set in the jugular notch with the necessary bent of the neck and the head. This has been shown in the pictures of Padmâsana and Siddhâsana given in this chapter later on. According to some traditions, however, the chin is not set in that notch, but pressed against the chest further down about four fingers below it. Figs. 13 and 14 illustrate this.

The Chin-Lock may be practised as a part of Padmâsana and Siddhâsana or independent of them.

This Bandha exercises an upward pull upon the spine and *most probably* upon the spinal cord, and thus works upon the brain. The Yogic tradition traces the name Jâlandhara-Bandha to this circumstance ; the word Jâla referring to the brain and to the nerves passing through the neck, and Dhara denoting the upward pull. Is it possible for the name of the Bandha to be taken from the great Yogin Jâlandhara, who was, perhaps, its inventor, or, at any rate, its famous exponent ?

Fig. 13.—Jâlandhara-Bandha or the Chin-Lock.
(*Front View*)

Fig. 14.—Jâlandhara-Bandha or the Chin-Lock.
(*Side View*)

MÛLA-BANDHA OR THE ANAL CONTRACTION

Mûla-Bandha is an exercise which *mainly* consists in forcibly contracting the anal sphincters. It also requires the perineum to be closely pressed by the heel, as illustrated in Fig. 17 and as described later on in this chapter in the technique of Siddhâsana.

Mûla-Bandha may be practised as a part of Siddhâsana or independent of it.

There are two anal sphincters, one internal and the other external, situated at the end of the rectum. Both are formed by circular muscles, the external sphincter constituting the anus.

Although the anal contraction alone goes to form Mûla-Bandha, in contracting the anus one necessarily contracts the whole pelvic region. Hence virtually Mûla-Bandha is an exercise of pelvic contraction.

This Mûla-Bandha is intended to work upon the central and sympathetic nervous systems through the nerve terminals in the anal sphincters. It is called Mûla-Bandha because it first concerns itself with the lower ends of the nervous system in the human trunk.

Caution—A mistake in the practice of this Bandha leads to hard constipation and upsets the digestive system. The genitals are also involved in this contraction and a mistake in its execution may result in some trouble in that direction also. Hence students of Yoga are advised to proceed systematically into this business.

PADMÂSANA OR THE LOTUS POSE

This pose is called Padmâsana because it is in imitation of the lotus that the hands and feet are arranged in this Âsana. Padma, in Saṅskṛita, means a *lotus*. Possibly the two feet placed on the opposite thighs represent the lotus leaves, and the two hands arranged one above the other stand for the blooming lotus. Fig. 16 illustrates the full pose.

The student first takes his seat with his legs fully stretched out. He then bends his right leg in the knee-joint ; and folding it upon itself, sets the same in the opposite hip-joint, so as to make the foot lie stretching at the root of the thigh with its sole upturned. (Vide Fig. 15). The other leg is similarly folded and set in the opposite hip-joint. Both the heels he adjusts in such a way that they almost meet in front of the *pubic* bones and each of them presses on the abdominal portion adjacent to it. (Vide Fig. 16). Then on the heels thus brought together, the left hand is spread out with its back touching the heels and its palm upturned. The right hand is placed upon the left in the same manner. The eyes are directed to the nose-tip as described on p. 30 ; and the Chin-Lock is formed after the manner indicated on p. 34. With the Anal Contraction treated on p. 35, the technique of the Lotus Pose is completed. It is needless to add that except for the neck, the spine is to be maintained erect.

The most important features of Padmâsana are the two Bandhas—Jâlandhara and Mûla. As these are to be cautiously practised, it is always desirable, for the student of Yoga, first to pick up the Bandhas and then start with this pose.

FIG. 15.—Preparation for Padmâsana.

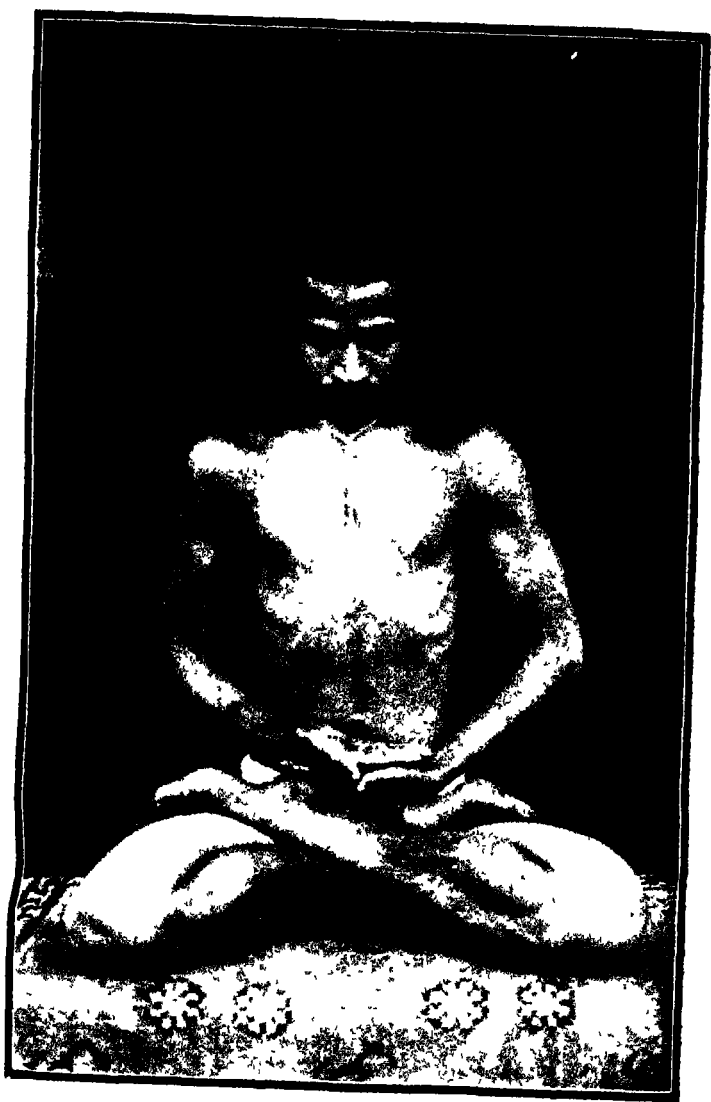



Fig. 16.—Padmâsana or the Lotus Pose.

Caution— In India many people are desirous of sitting in Padmâsana for their daily prayers. We advise these people to assume the Lotus Pose without the Bandhas, if they have not already picked them up successfully. When practised without Bandhas, this Âsana may be continued for any length of time, provided one can sit in it all the while without any sense of discomfort. The advice and caution given in the notes on these Bandhas, also hold good in the case of Padmâsana, if the student is anxious to go through the complete technique of this posture.

SIDDHÂSANA OR THE ACCOMPLISHED POSE

The pose is called Siddhâsana because it is favourite of the accomplished Yogins. Siddha, in Sanskrita, means an *adept*.

The student first takes his seat with his legs fully stretched out. He then bends his left leg in the knee-joint; and folding it upon itself, sets its heel tightly against the perineum. (Vide Fig. 17). In order to get the perineum clear for this purpose, he has first to hold up his genitals with the left hand, for the right hand is occupied in setting the heel in its proper place. The sole of the left foot should be closely in touch with the right thigh. No attempt should be made to sit on the heel. That is a wrong procedure, because pressure is to be exerted on the perineum and not on the anus. The adjusted heel should feel the hard touch of the bones on the two sides of the perineum. After the left leg is given its proper position, the genitals should be arranged within the space available between the left thigh and the left calf. This being done the right leg should be folded after the manner of the left, its heel being placed against the *pubic* bones just above the penis. (Vide Fig. 18). The right sole should spread along the left thigh, the lower border of the right foot being thrust between the left thigh and the left calf. Care must be taken not to hurt the genitals. Generally they can be accommodated below the right heel. But if they cannot find sufficient space there, the testes may be lodged there and the penis may be made to lie outside the folded legs. Under no circumstances undesirable pressure should be put upon any of the organs concerned.

The chin is set against the chest, just as in Padmâsana, to form Jâlandhara-Bandha. The eyes, this time, do not,

FIG. 17.—Preparation for Siddhâsana.

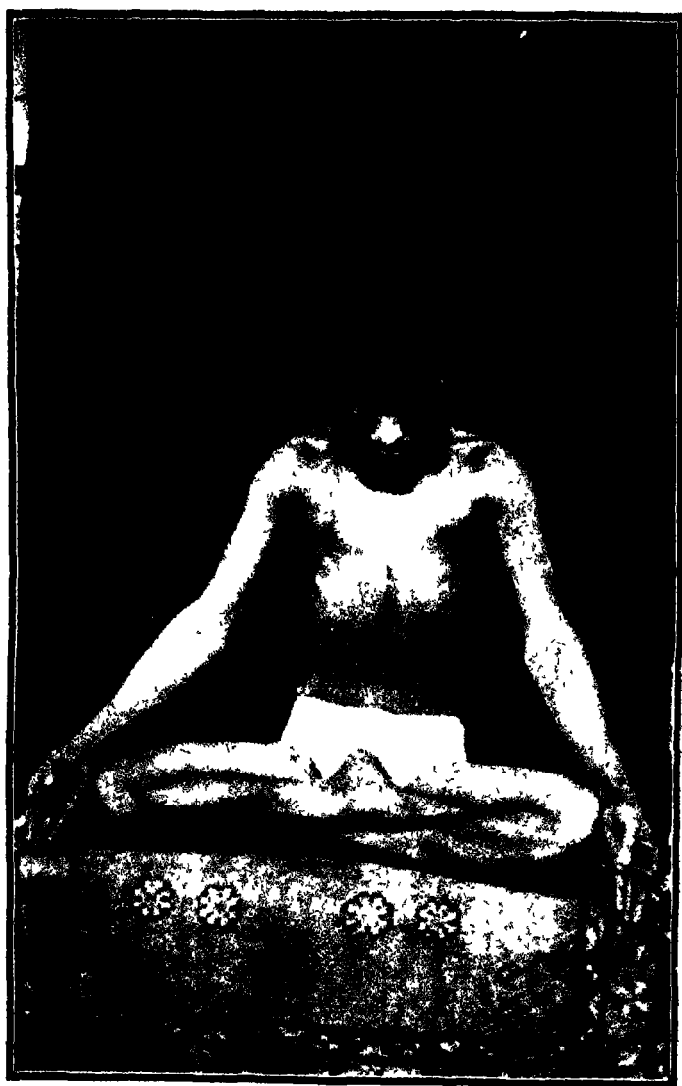



Fig. 18.—Siddhâsana or the Accomplished Pose.

however, gaze at the tip of the nose ; but are directed between the eyebrows, as described on p. 31, securing Bhrûmadhya-Dṛishṭi for the student. Except for this bent of the neck the spine is to be erect.

The hands and fingers may be arranged as shown in Fig. 18 or the hands may rest on the knees, touching them with their palms.

The pose should be developed gradually avoiding every possibility of uncomfortable pressure. The period of time given to its daily practice should increase slowly.

Note— In some of the vernacular books on Yoga, the pose is said to affect the sexual powers adversely. So far as our experience goes, there is little evidence in support of this view, in the case of healthy persons. It is, however, desirable not to exceed an hour's practice, without special permission of an expert.

This and the preceding Âsana are principally practised for spiritual culture. When rightly advised they are also available for purposes of physical culture and therapeutics.

SVASTIKÂSANA OR THE AUSPICIOUS POSE

This pose is called Svastikâsana because it involves crossing of the legs which is looked upon by the Âryans as auspicious. In Sanskrita Svastika means *auspicious.* In classical Sanskrita the word Svastika is used even for the *crossing of the hands.* The reason is that the mysterious symbol Svastika is mainly represented by two lines crossing each other at right angles. Hence positions involving the crossing either of hands or of legs are also called Svastika. Fig. 20 which illustrates Svastikâsana, clearly shows how in this Âsana legs cross each other above the ankles.

The student starts by stretching out his legs on his seat. Then he bends one of his legs, say the right, in the knee, and folds it on the thigh, just as in the case of Siddhâsana. But there is a difference in the ultimate position of the foot in this pose and in Siddhâsana. In the latter pose the heel is set against the perineum, whereas in Svastikâsana it is to be set against the opposite groin, so as to allow the corresponding sole to be in close touch with the opposite thigh. (Vide Fig. 19). Then without disturbing the position of the heel, the student raises the toes of his right leg with his left hand. Simultaneously he folds his left leg upon the thigh in such a way that the big toe of his right leg may project itself above the calf and the thigh between which it is held, and the left heel may be firmly set against the right groin. The toes of the left foot are inserted between the right calf and the right thigh already folded upon each other, allowing only the big left toe to lie free. (Vide Fig. 20). Needless to say that in this position the sole of the left foot stretches above the right thigh touching it closely all along. In this pose the legs

Fig. 19 — Preparation for Svastikâsana.

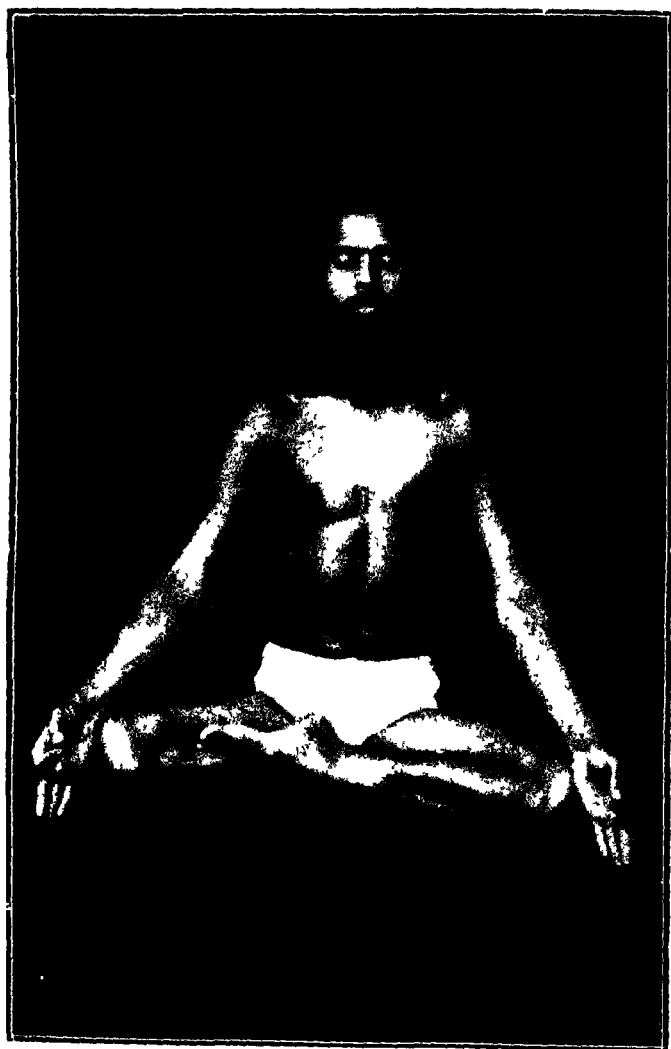



Fig. 20.—Svastikâsana or the Auspicious Pose.

should be made to cross each other just above the ankles, so that all unpleasant pressure on the bones will be avoided. When the legs are properly adjusted a sort of foot-lock is prepared which one finds very comfortable, and capable of being maintained for a considerable length of time.

The spine is to be kept erect. No attempt is, however, to be made to throw out the chest. Svastikâsana is a meditative pose and as such requires to be maintained for a long time. Any attempt to give an artificial bent to the vertebral column is likely to involve a strain.

The arms may hang loosely from the shoulders and rest on the knees covering them with their palms. Or they may be stretched out a little further so as to rest the wrists on the corresponding knees. In the latter case, the hands are formed into what is called Jn'âna-Mudrâ[1] in Yoga. Fig. 20 illustrates the full pose.

A third way of arranging the hands is shown in Padmâsana. (Vide Fig. 16).

Instead of starting with the right leg, the student may start with the left. He might then go through the whole technique, introducing corresponding changes throughout.

The eyes may either be closed as illustrated in the opposite picture or either the Nasal Gaze or the Frontal Gaze may be practised. (For the two gazes see respectively Figs. 8 and 9).

All over the lower extremities, the flexors are greatly contracted and pressed.

---

1 The technique of this is given in the next chapter under subheading 'Mudrâ'.

This circumstance coupled with the passive condition of all the muscles of the lower extremities maintained for a considerably long time, interferes with the free current of blood circulation. That being the case, the pelvic region gets a larger blood supply from the bifurcations of the abdominal aorta.

The larger blood supply mentioned above tones up the coccygeal and sacral nerves.

FIG. 21 — Preparation for Samâsana

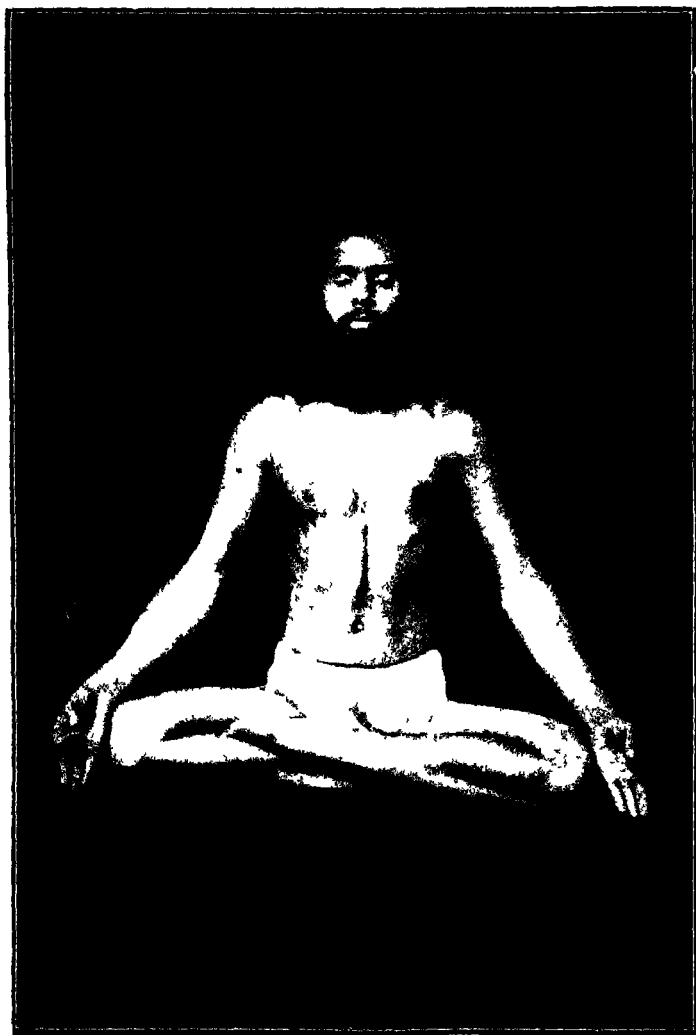



Fig. 22.—Samâsana or the Symmetrical Pose.

SAMÂSANA OR THE SYMMETRICAL POSE

This pose is called Samâsana because in its performance all the parts of the human body are symmetrically arranged and a perfect balance is maintained. In Sañskrita Sama means *symmetrical.*

Guptâsana is another name given to this pose. In Sañskrita Gupta means either *well protected* or *secret.* The pose looks to be called Guptâsana because in executing it, genitals are well protected under the heels of man. Or it may be that the Âsana was practised secretly by a particular school of Yogins and continued to be their secret possession, till it became known to others and hence acquired this name.

The only difference in the technique of this Âsana and the previous one, lies in the arrangement of the heels. In Svastikâsana the right heel is pressed against the opposite groin and also the left. But in Samâsana the right and the left heels are to be set against the *pubic* bone, that is, the bone just above the penis. This is done as follows. While the right leg is being folded on the corresponding thigh, the student holds the heel in his right hand and the toes in his left. Then he turns the heel upward and the toes downward, and arranges the foot in his front in such a way that the heel presses against the *pubic* bone, the sole is turned up, and the upper surface of the foot touches the ground. (Vide Fig. 21). Care must be taken at this time to see that the genitals are placed below the heel in such a way that no pressure is exerted on the testis. The other leg is similarly folded, and the other heel is placed upon the first heel, pressing against the *pubic* bone. The toes of the other leg are to be inserted between the calf and thigh of the first leg. (Vide Fig. 22).

The arrangement of the hands and eyes in this Âsana admits of as many varieties as in the previous Âsana. The spine is to stand erect and the whole body to be kept in balance.

So far as could be observed up to now from the physiological point of view, Samâsana seems to have the same effect upon the muscles, blood-vessels and nerves as Svastikâsana.

Note— As in this pose the space below the heels is just sufficient to accommodate genitals of the normal size, persons who are suffering from hydrocele etc., should not attempt this Âsana.

CHAPTER III

PRÂṆÂYÂMA IN GENERAL

PLACE OF PRÂṆÂYÂMA IN YOGIC CURRICULUM

THE course of Yogic study is divided into eight parts. Âsana constitutes the third part. A student of Yoga passes on to Prâṇâyâma after mastering Âsana. In the present chapter we propose to treat this fourth item of the Yogic curriculum in general, details of the different types of Prâṇâyâma being reserved for separate chapters that follow. Again in the present chapter we shall first give a general idea about Prâṇâyâma and then discuss a few technicalities common to all the varieties of Prâṇâyâma.

MEANING OF PRÂṆÂYÂMA

Prâṇâyâma[1] means a *pause in the movement of breath*. In Saṅskrita Prâṇa means *breath* and Âyâma means a *pause*. In modern literature on Yoga, Prâna, even in the compound Prânâyâma, has been often interpreted to mean a *subtle psy-*

1 In the language of the later Yogic literature Prâṇayâma is called Kumbhaka. It is interesting to note here that Patan'jali does not use the words Rechaka (Exhalation), Kumbhaka (Pause) and Pûraka (Inhalation), anywhere in his Sûtras, although he does refer to these actions. His oldest commentator Vyâsa, who lived in the first century, A D., also does not use the terms Rechaka, Kumbhaka and Pûraka. This circumstance clearly shows that this nomenclature was introduced at a later date. Tracing the history of the development, of not only these terms but many others used in the Yoga S'âstra, would be a fruitful research problem for a student of Yogic literature.

chic force or a *subtle cosmic element.* We do not think that the original Sanskrita text of Bhagavân Patan'jali's *Yoga-Sûtras* any way warrants this interpretation. In these Sûtras the word Prâna occurs by itself only once[1] and the wording of the Sûtra is so clear that by no stretch of imagination can the word Prâṇa there be taken to refer to anything except *breath.* In addition to this the word Prâna occurs twice in the Sûtras[2], every time being compounded with the word Âyâma. Here again the wording of the original author, Patan'jali, is very clear. He positively refers to respiratory movements. The

---

1 प्रच्छर्दनविधारणाभ्यां वा प्राणस्य । P Y S., I 34.

Bhagavân Patan'jali is discussing the different means of bringing the mind under control He has suggested various measures and one of them is contained in this Sûtra. The word Prachchhardana would always mean *expulsion* and must in this Sûtra refer to breath and not to any subtle psy. chic force or cosmic element. Vidhârana means *retention.* When all the three words Prachchhardana, Vidhârana and Prâṇa are taken together, they irresistibly drive us to the conclusion that the word Prâna here refers to breath and breath alone. The Sûtra means that an alternative measure for controlling the mind, is available in the alternate expulsion and retention of breath This is not the place for discussing the question as to whether this Sûtra refers to a particular type of Prâṇâyâma or to Prâṇâyâma in general.

Vyâsa and other commentators have explained Praṇa occurring in this Sûtra as कोष्ठ्यो वायु meaning *air from the chest* and thus have left no ambiguity in the interpretation of the word.

2 यमनियमासनप्राणायामप्रत्याहारधारणाध्यानसमाधयोऽष्टावङ्गानि । P.Y.S ,II29. This is the first of the two Sûtras It lays down the eight successive items of the Yogic curriculum, having Prâṇâyâma as the fourth in order. Then follows the second Sûtra to define the word Prâṇâyama.

तस्मिन्सति श्वासप्रश्वासयोर्गतिविच्छेदः प्राणायामः । P.Y.S , II 49.

Here the words S'vâsa and Pras'vâsa which can never mean anything else than the *air flowing in* and *flowing out*, make the meaning absolutely clear. गतिविच्छेदः is a *pause in the movement.* Thus we see that the word Prâṇa occurring in the technical word Prâṇâyâma, according to Patan'jali and his commentators, means breath and breath alone It never indicates any psychic force or cosmic element.

most important commentators of Patan'jali's Sûtras have invariably explained Prâna to mean breath, in their commentaries on the three Sûtras referred to above.

We definitely know that authors of Hatha texts very often use the word Prâṇa to indicate a subtle psychic force. But this they do when they talk of the force awakened by the process of Prânâyâma and not of Prâṇâyâma itself. Even with these authors of Hatha, the word Prâṇa as it occurs in the compound Prâṇâyâma has only one meaning and it is *breath.* So our conclusion is that in Yogic literature Prâṇâyâma means only a pause in the movement of breath.

PATAN'JALI'S FOUR TYPES OF PRÂṆÂYÂMA

Bhagavân Patan'jali notices four types of Prâṇâyâma, the distinction being based upon the nature of the pause. For instance when the pause is made after a thorough exhalation, that would constitute the first type of Prâṇâyâma. The second type of Prâṇâyâma would be available when the pause comes after a deep inhalation. In both these cases the Yogic student is required to make a special effort for holding his breath either in or out. But in the third and fourth types of Prâṇâyâma the student is not required to make any special effort to hold his breath. The respiratory movement may stop all at once, when the student wants it to stop, the pause being continued over a considerable time without any physical effort on the part of the student. This constitutes the third type of Prâṇâyâma. The fourth type is similar to the third. The only difference between the third and the fourth types, is that in the third the pause comes all at once, whereas in the fourth a similar pause is brought about by many inhalations and exhalations preced-

ing it. The absence of effort in maintaining the pause is common to both, the third and the fourth types of Prânâyâma.[1]

In the language of the later Yogic literature, the first type of Prâṇâyâma is called *Bâhya*[2] *Kumbhaka*, the second type *Âbhyantara*[2] *Kumbhaka*, and the third and the fourth types are called *Kevala*[3] *Kumbhakas*.

SVÂTMÂRÂMA'S EIGHT VARIETIES OF PRÂNÂYÂMA

Svâtmârâma Sûri, the author of Hatha-Pradîpikâ, the most authoritative text-book of Haṭha Yoga, mentions eight[4] varieties of Kumbhaka which is with him another name for Prâṇâyâma. It is interesting to note that the principle of division followed by Svâtmârâma in distinguishing his Kumbhakas, is different from the principle adopted by Patan'jali. We have seen that Bhagavân Patan'jali distinguished the different

1 In stating this fourfold distinction of Prâṇâyama according to Patan'jali, we have followed his commentators We ourselves have a different interpretation for the Sûtras concerned

2 The words Bâhya and Âbhyantara alone are used by Patan'jali.

3 Some idea of Kevala Kumbhaka can be had from what is known to modern physiology as *apnea*, provided it is prolonged Apnea is defined as a transient cessation of respiration from an overabundance of oxygen as for example, after forcible respiration.

NOTE— Hereby we do not at all want to suggest that Kevala Kumbhaka is only a prolonged apnea Although we know what Kevala Kumbhaka is in practice, we have not yet tried any experiments with it for understanding its physiology. And having pledged ourselves to a strictly scientific policy, we cannot make any statement that is not backed up by laboratory evidence. The physiological apnea has been stated here only to convey an idea as to what a Kevala Kumbhaka is like.

4 सूर्यभेदन, उज्जायी, सीत्कारी, शीतली, भस्त्रिका, भ्रामरी, मूर्च्छा and प्लाविनी are the eight varieties of Kumbhaka. Of these we are going to notice Ujjayî and Bhastrikâ in this part of the present handbook.

Prâṇâyâmas, according to the nature of Kumbhaka itself. But Svâtmârâma Sûri tries to make a distinction between a Kumbhaka and a Kumbhaka, not because the nature of the Kumbhakas themselves is different, but because the nature of the inhalations and exhalations between which these Kumbhakas occur, is different. Thus the technique of all the eight Kumbhakas is the same. But the technique of the inhalations and exhalations differs in every case. These differences we shall notice when we proceed to study the various Kumbhakas in this and the second part of this handbook.

DIFFERENT UNITS FOR MEASURING PRÂṆÂYÂMA AND THE RELATIVE MEASURES OF ITS COMPONENT PARTS

Each round of Prâṇâyâma is generally[1] a complex act and consists of *Pûraka* (Inhalation), *Kumbhaka* (Pause) and *Rechaka* (Exhalation). We want to see what units are prescribed for measuring these parts and what relative measures we should maintain among these component parts of a complex Prâṇâyâma. But before we do so we wish to touch one more point in brief. It has already been noticed in one of the foregoing foot-notes that neither Patan'jali nor Vyâsa uses the words, Pûraka, Rechaka and Kumbhaka. So we should try here to see what terminology they used instead.

It has already been made clear that Prâṇâyâma is the technical word for Kumbhaka, both with Patan'jali as well as Vyâsa. Patan'jali also uses the word Vidhâraṇa[2] for Kumbha-

1 We have used the word *generally* because in Kevala Kumbhaka there is neither Pûraka nor Rechaka.

2 प्रच्छर्दनविधारणाभ्यां वा प्राणस्य । P.Y.S., I 34, where Vyâsa explains Vidhâraṇa by the word Prâṇâyâma.

ka. Prachchhardana which occurs in the same Sûtra as Vidhâraṇa is clearly Patan'jali's word for Rechaka. It is explained by Vyâsa as the forcible expulsion of the air from the chest.

Now the question is what word is used by Bhagavân Patan'jali for Pûraka. So far as we understand the text of his Sûtras, we are afraid, we do not come across any word for Pûraka in his work. We know the words Śvâsa and Praśvâsa used by him in his definition of Prâṇâyâma.[1] But we feel sure that Patan'jali uses these words for the *air* flowing into the lungs and the *air* flowing out of them respectively. Pûraka is a process and not the *air* being inhaled. So we want a word in antithesis to Prachchhardana or Rechaka, which would denote the process. That word we do not find in the text of the Sûtras.[2] We should not be understood to mean that Patan'jali does not recognize the Pûraka action. That action he does recognize when he refers to Âbhyantara Prâṇâyâma which must be preceded by Pûraka. Our contention is that in the text of the Sûtras itself, there is no word explicitly denoting the process of Pûraka.

---

1 Vide foot-note 2, p 40

2 We know the extreme elasticity of the rules of interpretation of Sanskrita texts We are sure that a Paṇḍita versed in logic and rhetorics will successfully prove that S'vâsa occurring in the Sutra तस्मिन्सति श्वास-प्रश्वासयोर्गतिविच्छेदः प्राणायामः । means Pûraka. But we are not sure whether he will be able to explain *consistently* all the Sûtras of Patan'jali bearing on Prâṇâyâma, from a *practical point of view*, and yet will interpret S'vâsa as the *process of Pûraka.*

The question we are discussing here is very complicated. It is rendered more complicated by the successive commentators who were anxious to find *up to date* information in the Sûtras of Patan'jali Our attitude is to make the Sûtras consistent in themselves, irrespective of the later developments of Yogic exercises and Yogic terminology We do not think that Patan'jali would be condemned as a writer of an incomplete Yogic text, simply because he does not refer expressly to the different types of Prâṇâyâma described by later writers on Yoga.

So we find that Patan'jali's word for Kumbhaka is either Prâṇâyâma or Vidhârana and for Rechaka his word is Prachchhardana. Patan'jali does not use any word for the process of Pûraka.

Next we go to the units laid down for measuring Kumbhaka, Rechaka and Pûraka. The Yogins of old were very particular about the mathematical accuracy of their processes. They were anxious to measure everything precisely in terms of time-units and space-units. We must remember that these seers had neither clocks nor any other instruments that would measure accurately very small fractions of time. So they had to depend upon time-units determined by some physical action. Each time-unit was called a *Mâtrâ*. The following physical actions were singled out to denote a time-unit or Mâtrâ :—

(i) The twinkling of an eye.

(ii) Time taken to pronounce a short vowel.

(iii) Time necessary for touching one's knee thrice followed by a clap.

(iv) Time occupied by one normal respiration.

(v) Time taken up in pronouncing the sacred syllable ॐ. Etc., etc.

Our readers will immediately see that this sort of calculation is very vague. Nor do the units agree mutually. Not that the ancient seers were unmindful of this fact. The very attempt to introduce *different* standards for determining the time-unit, shows that none of them was found to be quite satisfactory. But it has to be remembered that the practice of Prâṇâyâma was taught by the master to his pupil in person. So whatever the length of the time-unit accepted by a partic-

ular school of Yogins, the student could learn to note it accurately from his master. Moreover at the time of practising Prâṇâyâma, one has after all to *judge* the Mâtrâ, that is, has to determine it by a mental process. So there was no difficulty in teaching accurately the length of time that constituted a Mâtrâ ; of course in each case as much accuracy would be ensured as was available by *judging* the time. To-day a practical student of Yoga need not worry himself over the diversity of these time-units. He should cultivate the habit of counting one, two, three...... at the interval of a second. A few minutes' practice in consultation with his watch, will make him perfect. Those that so wish it, should prefix ॐ to each number. ॐ one, ॐ two, ॐ three and so on.

Next we come to space-unit. This was necessary for measuring the force with which the inhalations and exhalations were practised. In a forced exhalation the current of the expired air can be felt up to a particular distance from the end of the nose. The more forcible the exhalation, the greater will be the space across which the flow can be detected. Very light organic fibres were suggested to be used for detecting this current. The affected space was measured in fingers, etc. So the length of the air current determined the degree of pressure with which one was exhaling in Rechaka.

The way of determining the strength of Pûraka as described by the commentators of the original Sûtras, is somewhat difficult to understand. The measure of the strength of Pûraka must naturally lie along the inward flow of the inspired air. In our humble opinion the sensations which have been described as marking the space-unit of Pûraka are extremely vague and may not give even a tolerably accurate idea even

to an advanced student of Yoga. So we do not attempt any description of this space-unit here.

For all practical purposes, spiritual as well as physical, the following hints will suffice.

(i) The length of time to be given to Pûraka should be half of what is being given to Rechaka.[1]

(ii) Throughout Pûraka, the inhalation should be uniform.[2] That is the strength of the flow should be of the same degree throughout. The act should neither be slowed down nor hurried up.

---

1 We shall state later on what time should be given to Rechaka.

2 Either in the case of Pûraka or in the case of Rechaka if the time-unit is taken care of, and a uniform flow of breath is secured, the space-unit takes care of itself We shall explain how

At a particular stage of development a student of Yoga is able to inhale a particular quantity of air and exhale a similar quantity. The measure of this air, as we have shown in the chapter on respiration, determines the vital capacity of the individual. Let us suppose that the student is able to inhale 3500 c c and exhale as many. Now if the inhalation is uniform, and occupies, say, ten seconds, roughly speaking, some 350 c c. of air will flow in every second But if the inhalation were to take seven seconds instead of ten, some 500 c c. will be drawn in per second. It can be easily seen that the force required for drawing in 500 c.c., must be greater than the force required to draw in 350 c.c., if the work is to be done within the same length of time. Again if the inhalation were to require fourteen seconds, the quantity of air inspired per second would be 250 c c. only. Hence the force necessary for this work will be less than that required in the ten seconds' Pûraka. So the force required to be exerted in seven seconds', ten seconds' and fourteen seconds' inhalations, varies inversely as the length of time occupied by the inhalation. The shorter the time of inhalation, the greater will be the force required to carry out the action. Thus the force and the length of time being inversely proportionate, we can regulate the force by regulating the time. And once the force is determined, the space-unit is also determined. Hence if we take care of the time-unit and ensure a uniform flow, the space-unit will take care of itself. What has been said here of Pûraka, applies to Rechaka also.

(Continued)

(*iii*) Every Pûraka must end quietly. Many people are in the habit of contracting most violently muscles of the whole body at this stage. It is to be noted that no amount of violence done to muscles other than respiratory, will enable a person to draw in even one additional c.c. of air.

The time-unit is applicable even to Kumbhaka. The practical method of measuring the length of time occupied by Pûraka and Rechaka that we have described above, should also be used for Kumbhaka.

Having studied the Mâtrâs by which we can measure Pûraka, Kumbhaka and Rechaka independent of one another, we now proceed to see what relation these three component parts of Prâṇâyâma should bear among themselves so far as their duration is concerned. In this connection the most favoured view *is to have the durations of* Pûraka, Kumbhaka and Rechaka in the proportion of 1 . 4 : 2. According to another tradition, this proportion should be 1 : 2 : 2. Thus if Pûraka consists of sixteen Mâtrâs, Kumbhaka should be of sixty-four and Rechaka of thirty-two Mâtrâs, according to the first proportion. And according to the second proportion for sixteen Mâtrâs of Pûraka, both Kumbhaka and Rechaka should have thirty-two each. There is a third tradition which lays down the same measure for all the three parts of Prâṇâyâma.

This is all right so far as the *relative* durations of Pûraka, Kumbhaka and Rechaka are concerned. But what should be the absolute durations of Pûraka or Kumbhaka or Rechaka, one

This explanation of ours is likely to make our readers curious as to why Bhagavân Patan'jali should have introduced both the space-unit as well as the time-unit in measuring his Prâṇâyâma. We have an explanation for this also, but we cannot give it here for want of space.

of which being fixed, would fix up the other two. Here the safest course would be first to settle the Mâtrâs of Kumbhaka and then to follow any of the proportions stated in the foregoing paragraph. Individually we are in favour of the second proportion for a beginner, although an advanced student can follow the first proportion without any danger to himself. Again in fixing up the Mâtrâs of Kumbhaka, a beginner should see that he can hold his breath very comfortably during the whole duration. Not only this but he should also see that he is able to perform Rechaka in due proportion with an equal degree of comfort. The whole practice of Prâṇâyâma should be gone through with utmost ease and comfort. No jerks, no violence, no undue sense of suffocation should be there at any stage of Prâṇâyâma.

We very strongly advise the beginners to start only with Pûraka and Rechaka, their respective durations being in the proportion of 1 . 2. The physical culturist can get all the advantages he wants to derive from Prâṇâyâma, by the practice of Pûraka and Rechaka only.[1] *Even a spiritual culturist can make a good deal of progress without the practice of Kumbhaka.*[2] *So there should be absolutely no hurry about taking to Kumbhaka. So also when Kumbhaka is started, it should be very slowly and cautiously developed. Kumbhaka is the one thing in Prâṇâyâma which demands the utmost attention on the part of a student of Yoga.*

1 This statement is made after a prolonged study of facts not only in our wide curative and preventive practice of Yogic Therapy, but also after a large number of experiments in the laboratory

2 We have a number of Sâdhakas under training with us. It has been almost invariably observed that activity in some of the most important Chakras can be *started* simply by the practice of Pûraka and Rechaka, without taking to Kumbhaka at all. Of course for further developments Kumbhaka looks to be essential.

If, however, it is developed with due caution and care, there is nothing dangerous about it or about Prâṇâyâma as a whole.

The duration in Prâṇâyâma should be judged mentally. Both the physical culturists and the spiritual culturists should practise Prâṇâyâma with utmost concentration. The mind should very closely follow the movement of breath. In numbering the Mâtrâs the concentration on the breath is disturbed. Again the spiritual culturist, as he advances, is required to concentrate upon different points either inside the body or outside it. In this work the numbering of the Mâtrâs causes a little distraction. Those that can manage the numbering business without allowing their concentration being affected, may take to it if they so choose.

In a discussion on Prâṇâyâma a reference to Nâḍîs is absolutely necessary. Hence we proceed to a consideration of these.

THE NÂḌÎS

In later Yogic literature the Nâḍîs play a very important part. But either in Bhagavân Patan'jali or in the oldest commentary on his Sûtras written by Vyâsa, the word Nâḍî occurs only once.[1] There again the reference is to a Nâḍî that is comparatively of small importance. The total number of Nâḍîs present in the human body has been variously estimated. According to one author it is 72,000, whereas according to another it is as huge as 350,000. Nâḍîs are, however, distinguished as those of comparatively small importance, those of some importance and those of greater importance. One is singled out as the most important of the whole lot. The number of Nâḍîs of some importance is stated to be either ten or fourteen. There is, however, perfect agreement among

1 It is in the Sûtra कूर्मनाड्यां स्थैर्यम् । P.Y.S., III 31.

the authors of Yogic literature in mentioning the number of the more important Nâḍis as three[1] and also that of the most important as one.[2]

Can we identify these Nâḍis with any of the anatomical structures known to the modern science? Up to now various attempts[3] have been made for such an identification, at least

---

1 इडा, पिङ्गला and सुषुम्ना.

2 सुषुम्ना.

3 By far the boldest attempt in this direction has been made by Dr. V. G. Rele of Bombay in his book *The Mysterious Kundalini*. The book is certainly thought-provoking and Dr. Rele has worked hard at his thesis. He has taken full advantage of his knowledge of modern anatomy and physiology, and some of his guess-work has every chance of standing the laboratory tests. He has explored a very large field of Yogic physiology and anatomy, and every student of Yoga will ever feel indebted to him for this his labour of love. We heartily recommend the book to our readers' attention. But after all his conclusions are based upon *mere speculation*. Dr. Rele has not tried a single experiment in the laboratory, nor has he taken much care to consult the practical experience of the students of Yoga. As such, we are afraid, we cannot accept his conclusions as scientifically sound. Nay, we have serious doubts regarding the accuracy of many of his interpretations, and the whole book looks to be of doubtful scientific value. Dr. Rele very frankly admits in his preface to the book that his interpretations are 'possible suggestions only'. Another attempt in this direction that deserves special mention here, is that of the great Swâmî Vivekânanda. His Lectures on Râja-Yoga are full of interpretations of Yogic things in the light of modern sciences. We are sorry to note here that the Swâmiji's attempt suffers from the same drawbacks as the work of Dr. Rele. The whole structure is based upon the treacherous sands of speculation. Being pledged to accept nothing, in the field of scientific interpretation, as sound, unless it is backed up by laboratory evidence, we cannot accept the conclusions of the great master as scientific. We do not want to be misunderstood. We make a distinction between Yoga as a reliable guide for spiritual evolution, and Yoga being scientifically interpreted. For centuries, how many we do not know, Yoga is being practised as a means to self-realization. The traditional practices are as sound as anything known to modern science. We have adamantine faith in the efficacy of these exercises as a means to spiritual evolution. But the scientific inter-

(Continued)

in the cases of the important Nâḍis ; but all of them, so far as we know, have been of a literary character. No strictly scientific effort has been made to this day. Being pledged to a policy of strict scientific accuracy, we cannot accept the results of these efforts as scientifically sound. We too have many hypothetical conclusions regarding the Yogic anatomy and physiology. But we do not wish to place them before the public *as scientific*, unless we test them in the laboratory.

For the information of our readers, however, we shall mention the modern interpretations put upon the words Nâḍi, Sushumnâ, Iḍâ and Piṅgalâ. Without going into details, we shall also broadly say whether these interpretations are acceptable to us or not. Our acceptance or otherwise has, however,

pretations of the Yogic practices and Yogic anatomy and physiology, is quite a different thing. It means trying experiments upon these practices in the laboratory according to the strict scientific methods and basing one's conclusions on the results thus obtained. Evidently Swâmî Vivekânanda never tried these experiments and had to resort to speculation. This is a statement of facts and there is no intention to find fault with the Swâmijî His Lectures on Râja-Yoga are master-pieces of inspirational literature. We ourselves owe a deep debt of gratitude to the great master, especially as the author of his *Lectures on Râja-Yoga.* A third attempt which compels attention is that of Dr. Brajendranath Seal. In his very valuable book, *The Positive Sciences of the Ancient Hindus*, the Doctor attempts scientific interpretations of some of the Yogic anatomical terms. Even though his interpretations are better than those of Swâmi Vivekânanda and anticipate in particular respects those of Dr. Rele, they cannot be treated as scientifically sound. They are not supported by any laboratory evidence. But the oldest attempt in the direction of scientifically interpreting the Yogic anatomy seems to have been made by Major B. D. Basu who published an article on this subject in *The Theosophist* as far back as 1888 His interpretations though speculative certainly claim great admiration. It is a pity that those who followed Major Basu did not take advantage of his precious work. It is greatly surprising to find Dr. Rele not acknowledging his debt both to Major Basu and Dr. Seal, each of whom has anticipated some of his interpretations. Perhaps he did not know their works.

absolutely no scientific value, as it is based upon mere guess-work to-day.[1]

Nâḍîs have been identified with the nerves of modern anatomy. Although there are places in Yogic literature where the word Nâḍî has definitely been used in some other sense, this interpretation is on the whole acceptable to us. In fact the description[2] of the Nâḍîs in general given in one of the Yogic text-books, is so vivid and accurate, that there is little scope for any difference of opinion regarding the interpretation.

The same may be said about Sushumnâ. It is explained as the spinal cord. We have not got *much*[3] objection to this interpretation.

Iḍâ and Piṅgalâ are identified by Swâmî Vivekânanda[4] with the sensory and motor tracts of the spinal cord. We cannot accept this interpretation, however, as it does not tally with the description of these Nâḍîs in the original Saṅskṛita

---

1 We are trying our best to equip our laboratory with such apparatus as would enable us to conduct experiments on the Nâḍis. Everything else is ready. And by the grace of the Lord, we feel sure we shall soon have the desired equipment also

2 नाड्यस्तु ता अधोवक्त्राः पद्मतन्तुनिभाः स्थिताः ।
पृष्ठवंशं समाश्रित्य ... ... ॥ S'iva-Saṁhitâ, II 17.

[These Nâḍis are like the fibres of a lotus, and being supported by the vertebral column, spread downwards]

3 We say *much* because we too think that Sushumnâ is to be identified with the spinal cord. But we are not sure as to whether it is to be identified with the entire cord or only with a part of it.

4 Thus asserts the Swâmijî in his *Lectures on Raja-Yoga* —

"The columns of sensory and motor fibres in the spinal cord are the Iḍâ and Piṅgalâ of the Yogins. They are the main channels through which the afferent and efferent currents travel."

texts. Dr. Rele's interpretation[1] of Iḍâ and Piñgalâ as the mere chains of central ganglia, one on either side of the middle line of the vertebral column, is almost acceptable to us. In fact hypothetically we had come almost to this very conclusion even before Dr. Rele's book was published. Even now, however, we have some difficulties in fully accepting this identification of Iḍâ and Piñgalâ as even hypothetically final. Most probably we will have to modify it a little.

We have thus far studied the speculative identification of the Nâḍîs. Now we go to note a few more points concerning the Nâḍîs, because they often occur in Yogic literature.

It is believed[2] that inhalation through the right nostril creates heat in the body and inhalation through the left nostril creates cold. This has most probably led Yogins to describe the right Nâḍî, that is, Piñgalâ as Sûrya-Nâḍî. Sûrya means the *sun* and is the symbol of heat. In the same way Iḍâ is called Chandra-Nâḍî, Chandra, the *moon*, standing as a symbol of cold.

Again the word Nâḍis stands for the nostrils. Thus Sûrya-Nâḍî means either Piñgalâ or the right nostril, and Chandra-Nâḍî means either Iḍâ or the left nostril.

What has been said up to now is intended to get the modern student of Yoga in touch with the traditional phraseology. We have also given some hints to the practical student

1 Dr. Rele in his *Mysterious Kundalini* writes —

"From this description of the Nâḍis, Iḍâ and Piñgalâ, they are nothing but the gangliated cords of the sympathetic system, which we know are situated (one?) on each side of the spinal column." P. 35.

2 We are trying to collect laboratory evidence to test this belief, and although it is too early to say anything in the matter, we hope to find scientific support in favour of it.

of Yoga. Before closing this chapter, we shall, however, make some more practical suggestions to our readers.

OXYGEN VALUE VERSUS NERVE CULTURE VALUE OF PRÂṆÂYÂMA

The Westerner looks to exercises in deep breathing mainly from the point of view of its oxygen value.[1] He appreciates these exercises principally because they give him a larger quantity of oxygen to vitalize his system. With us the oxygen value of Prâṇâyâma is subordinate. We prize it more for its usefulness in nerve culture.[2] We make this statement not only for the spiritual culturist but for the physical culturist also. Let it be, however, borne in mind that even the oxygen value is not below our attention.

THE PLACE

Hence whether the student takes to Yoga for spiritual culture or physical, he must practise Prâṇâyâma in a very well ventilated place. He should not allow himself, however, to be exposed to a strong draught. Practising Prâṇâyâma in the open is extremely healthy. A spiritual culturist should, however, see that he avoids all disturbing factors. In his case the need for utmost concentration is extreme. Hence it is desirable that he chooses a thoroughly ventilated room which is free from mosqui-

1 We are conducting a number of experiments in our laboratory on the oxygen value of Prâṇâyâma. The whole material will be placed before the public when it is ready for publication. The data being collected are likely to add to our present day knowledge of metabolism.

2 For a full discussion on this very interesting but contraversial point, we refer our readers to *Yoga-Mîmâṅsâ*. In that journal we have put forth convincing evidence based on laboratory and clinical experimentation,

toes etc., and where he would be left to himself. Even the possibility of being disturbed, comes in the way of perfect concentration. If he could reserve a room for this work and build up a spiritual atmosphere there, it will help him a good deal in his work.

THE SEAT

For a spiritual culturist the traditional arrangement of seating is excellent. A carpet of Kuśa[1] grass, with a well tanned deer hide[2] spread on it, the hide in its turn being covered with a daily washed piece of thick khaddar, makes a very comfortable seat. The pleasures of such a seat are the peculiar privilege of those god-intoxicated aspiring souls who seek salvation through Yoga. The thrilling spiritual experiences that this seat affords to the student from day to day, make it more attractive to him than even the throne of an emperor !

A physical culturist is by no means barred from using such a seat. Even to him it will have its own attraction. But he need not be very particular about its use. He can practise his Prâṇâyâma while sitting, or while standing or even while walking.[3]

1 In the absence of a Kus'a grass carpet, any other grass carpet will do.

2 Those that may have a conscientious objection to the use of a hide, should make use of a thick woollen cloth folded over several times.

3 We cannot much appreciate the advice given to their followers by particular physical culturists, to practise Prâṇâyâma while taking violent muscular exercise. So far as we understand the physiological aspects of both Prâṇâyâma and violent muscular work, we have no hesitation in saying that it is impossible to practise Prâṇâyâma while violent muscular work is being done. One may hold his breath for a time during such a work and give it the dignified name of Prâṇâyâma or Kumbhaka, but any attempt to claim Pranayamic advantages for such a holding of breath, is as unscientific as it is misleading.

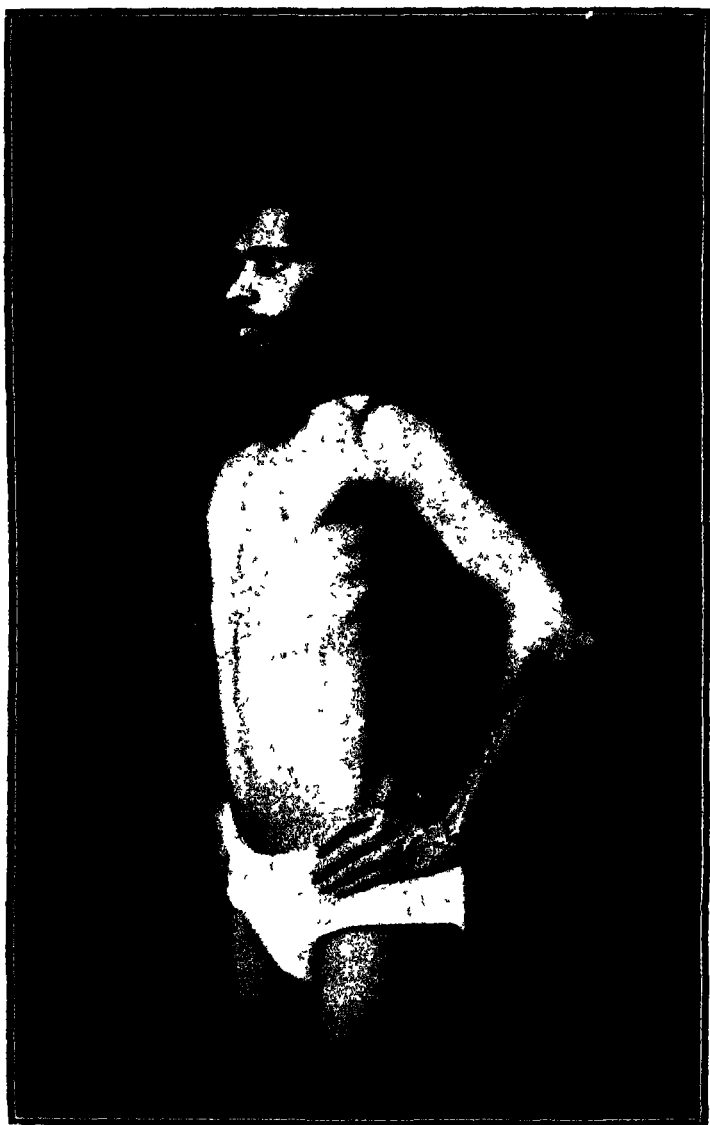



Fig. 23.—Correct Standing Position for Ujjâyî.

It is with the intention of giving the physical culturist an opportunity to practise Prâṇâyâma even in walking,[1] and yet not to go against the traditional rules of Prâṇâyâma, that we have arranged to give in this part of the present handbook, the technique of Ujjâyî. This is the only type of Prâṇâyâma allowed by the Yoga Śâstra to be practised even while one walks. It is principally for this reason that we teach Ujjâyî to every man that comes to us for Yogic instruction, be it for his body or for his mind.

THE POSTURE

If the physical culturist prefers to practise Prâṇâyâma while walking, no question of posture arises with him. Again if he chooses to have the practise of Prâṇâyâma in a standing position, the question of Âsana is of no consequence to him. He should, however, stand erect and rest his hands on his iliac bones.[2] (Vide Fig. 23). So also if a physical culturist thinks going through the Pranayamic exercises while sitting, he should assume an erect posture[3] and rest his hands on his knees. It is not necessary for him to assume any of the Yogic postures. The spiritual culturist shall always sit in one of the meditative poses described in the last chapter. The import-

1 गच्छता तिष्ठता कार्यम् । उज्जाय्याख्यं तु कुंभकम् ॥ Hatha-Pradîpikâ, II52.
[The Ujjâyî Prâṇâyâma may be practised even in standing or in walking.]

2 For a full discussion on the physiological significance of the technique of Prâṇâyâma we strongly recommend our articles in *Yoga-Mîmâṅsâ* to our readers. A few points have been made clear even in this part of the handbook in the foot-notes. It may be safely said that every point in the technique has its own scientific importance and should be carefully attended to.

3 Our article on the meditative poses appearing in *Yoga-Mîmâṅsâ* Vol. III, explains the hygienic value of an erect posture. The article is intended for the physical culturist as well as the spiritual culturist.

ance of Âsana in the process of his evolution, can never be exaggerated. The principal meditative poses are Siddha, Padma, Svastika and Sama. Of these we should specially recommend to our readers the first and the last. Both these Âsanas have a special spiritual value.

MUDRÂ

Spiritual culturists will do well to note in short the technique of what is known as Jn'âna-Mudrâ, the *symbol of knowledge*. This Mudrâ is practised as an accompaniment of a meditative pose. The palms are fully stretched out and the tip of the index finger, that is, the finger next to the thumb, is made to touch the tip of the thumb of the same hand. In this action, it is the forefinger that is bent to meet the thumb, the latter advancing a little, no doubt, to meet its fellow. Fig. 24 illustrates this Jn'âna-Mudrâ by itself, whereas Figs. 20 and 22 illustrate the same when practised as a part of Svastikâsana and Samâsana respectively.

BANDHA

The different Bandhas, namely, Uḍḍiyâna, Jâlandhara and Mûla, that play a prominent part in the practice of Prâṇâyâma have already been described in the last chapter. Under no circumstances should Kumbhaka be practised without Jâlandhara-Bandha. The practice of the other two Bandhas is optional.[1]

[1] The practice of Kumbhaka with the simultaneous exercise of all the three Bandhas is *highly dangerous*, if done without proper care and caution No student of Yoga should indulge in this exercise without the help of an expert.

FIG. 24.—Jn'âna-Mudrâ or the Symbol of Knowledge.

TIME

For a physical culturist any time half an hour before the meal, or four hours and a half after a full meal is available. Light refreshment does not preclude the practice of Prâṇayâma after some two hours.

A spiritual culturist should practise Prâṇâyâma twice a day, that is, morning and evening to begin with. As he advances he may take advantage of the midday and ultimately of midnight. Every time he must see that he has a thoroughly light stomach before he starts his Prâṇâyâma. His meals must always be moderate. One meal plan is the best for him. He must allow some six hours between his last meal and his exercises. Even after taking a moderate quantity of milk, he must not take to his practice at least for two hours.

In the morning the exercise of Prâṇâyâma should be tried after the cleansing processes of Dhauti, Basti etc., and even after the Âsanas. In the evening Prâṇâyâma should come after the Âsanas.[1] If any meditation is being practised, Prâṇâyâma should precede it.

THE CONCLUSION

In concluding this short chapter on Prâṇâyâma, we have to point out to our reader that the subject is very vast and requires volumes of information for its full treatment. These notes are intended for enabling the reader to follow the technique of the different types of Prânâyâma intelligently, and

1 Here we have simply indicated the sequence of the different Yogic practices. We do not mean that the other practices must necessarily be gone through before one takes to Prâṇâyâma.

also to help him in his Yogic practices. Prâṇâyâma is by far the most useful exercise for a physical culturist. To the spiritual culturist its importance is supreme. We are trying our best to supply scientific information to both these classes of readers in the volumes of *Yoga-Mîmâṅsâ*.

We earnestly request our readers never to allow their enthusiasm to get the better of reason. Prâṇâyâma is a weapon that easily lends itself to abuse. In playing with Prâṇâyâma, a man plays with his nerves, heart and lungs. Undue strain or imperfect methods in Prâṇâyâma may damage these parts permanently. So everyone should proceed into this business with due caution and care. When this is done and when our instructions are attentively and faithfully followed, Prâṇâyâma is perfectly safe. When rightly done, Prâṇâyâma will never fail to ensure supreme vitality for the body and eternal peace for the mind.

CHAPTER IV

UJJÂYÎ

THE NAME :—

In the last chapter we have explained the meaning of the word Prâṇâyâma. It has also been stated there that the author of *Haṭha-Pradîpikâ* gives eight varieties of Prâṇâyâma, one of which is Ujjâyî. We do not definitely know why this particular type of Prâṇâyâma is called Ujjâyî. We may, however, venture two conjectures about this name. In ancient India greetings consisted of the word Jaya which was always loudly pronounced. Hence the word Jaya and the cognate words came to be closely associated with loud pronunciation. Now the chief characteristic of the Ujjâyî Prâṇâyâma is the loud noise produced, as will be seen in the technique, by a partial closure of the glottis. Hence it is *possible* that this Prâṇâyâma is called Ujjâyî to distinguish it from other varieties. This conjecture of ours is rendered *probable*, when we take into consideration the two following facts. (*1*) The prefix Ud occurring in the name Ujjâyî (उद् + जायी), means *aloud*. (*2*) Ujjâpî, a variant reading noticed by Brahmânanda, in his commentary on Haṭha-Pradîpikâ, actually means *pronounced loudly*. Most probably the variant Ujjâpî was suggested because the original word Ujjâyî was not so clear in its meaning. So in all probability Ujjâyî also means *pronounced loudly*.

There is some possibility of the Prâṇâyâma being called Ujjâyî because its practice was supposed to lead one to success. Ujjâyî might be interpreted to mean *leading to success.*

THE TECHNIQUE[1] :—

The general instructions regarding the time, the place, the seat, the posture etc., given in the last chapter, are all applicable to Ujjâyî. We shall now give the particular technique of this Prâṇâyâma.

PÛRAKA :—

Before we describe the technique of Pûraka in Ujjâyî, we wish to refer to a point in the technique of Prâṇâyâma in general, so far as the inhalation and exhalation are concerned.

Generally speaking, during the course of Prâṇâyâma one is required to keep closed one nostril or the other, and in Kumbhaka both the nostrils. What is the orthodox way of closing the nostrils in Yoga? Tradition requires this work to be done in a particular manner. According to our view this manner of closing the nostrils is not only very comfortable but it is also scientific. The right palm is spread out. The index and the middle fingers are turned down, the other two fingers and the thumb remain extended. (Vide Fig. 25). Now the

1 Our readers are requested to master the chapter on respiration before trying to practise Ujjâyî according to the technique given here. The technique given here is intended for enabling the reader to pick up the practice. Nearly every point in the technique has a scientific explanation in its support. Some of these explanations are attempted in the foot-notes. For detailed discussion the readers are referred to *Yoga-Mîmâṁsâ*.

Fig. 25.—Preparation for Closing the Nostrils.

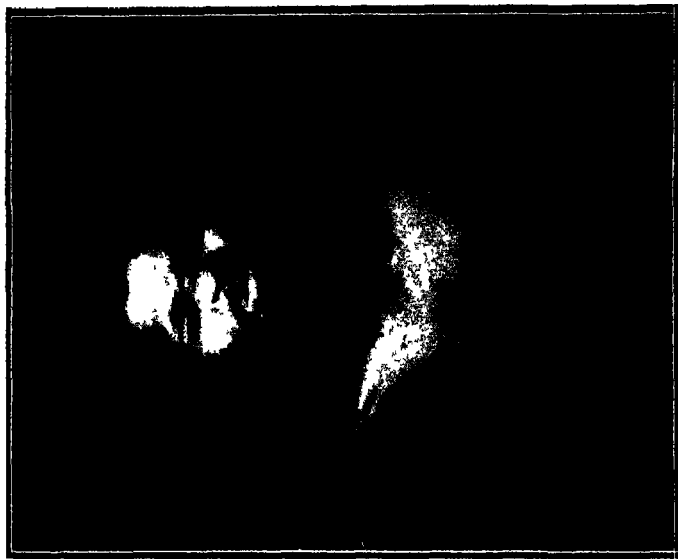



Fig. 26.—Ugly Contortions of the Face.

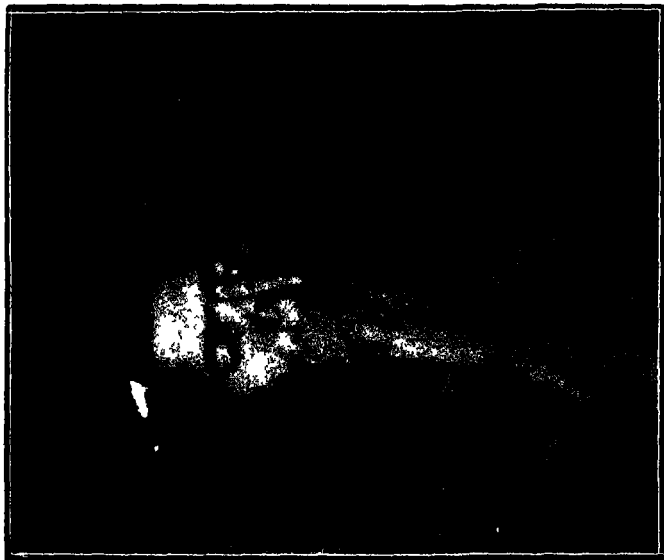



Fig. 27.—The Right Nostril Closed.

Fig. 28.—The Left Nostril Closed.

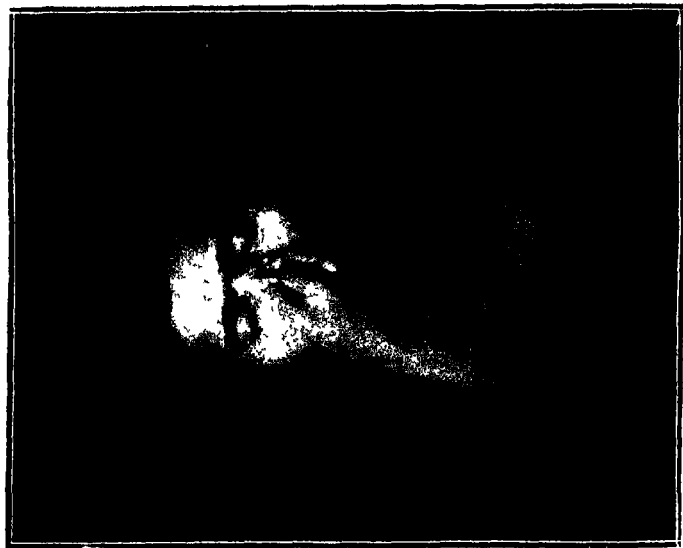



Fig. 29.—Both the Nostrils Closed.

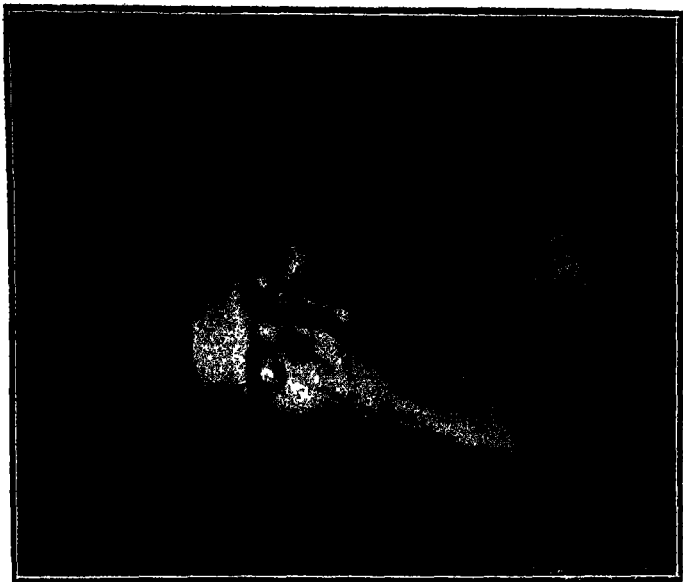



Fig. 30.—Both the Nostrils Open.

thumb and the extended fingers are placed on the bridge of the nose, the thumb on the right side of it, and the fingers on the left. Then if the right nostril is to be closed, the fingers are allowed to retain their position; but the thumb is slided downwards, and made to sit tight upon the elastic right nostril, pressing it against the septum at the side and the hard bone above. (Vide Fig. 27). Again if the left nostril is to be closed, the thumb is taken back to its original position on the bridge of the nose; and the fingers are slided down to sit tightly upon the left nostril, pressing the elastic part against the septum at the side and the nasal bone above. (Vide Fig. 28). If both the nostrils are to be closed, both the thumb and the fingers are slided down, pressing against the nostrils as in the last two cases. (Vide Fig. 29). But if both the nostrils are to be kept open, there are two positions for the right hand. The fingers and the thumb may rest on the bridge of the nose or the right hand may be taken down to rest on the knee as shown in Fig. 20 or 22. The first position (vide Fig. 30), is preferable, when alternating with the open nostrils, one of the nostrils is to be kept closed, as in the case of Ujjâyî. But the second position should be preferred, if there is no alternate closure of the nostrils. Now we come to Pûraka.

Every Pûraka, including the first, is to start after complete exhalation. In Ujjâyî, breath is to be drawn in through both the nostrils. In drawing in the breath the work is to be done with the chest. The student is to expand it and air will automatically rush in.

Throughout the inhalation, the glottis is to be partially closed. This partial closure of the glottis will produce a continuous sound like the sound that is produced in sobbing. The difference is that in sobbing the sound is abrupt and broken. Here it is continous. At the time of inhalation the facial muscles or the muscles of the nose should not be contracted. The contraction of facial muscles is of absolutely no use in inhalation. Some people are in the habit of having ugly contortions of the whole face, when they try to inhale. (Vide Fig. 26). This is to be completely avoided.

Special care is to be taken of the abdominal muscles. They should be kept under proper control with a very slight contraction which is to be maintained throughout the inhalation. Fig. 31[1] illustrates this control. It can be better observed in Fig. 32 which shows a side view of the same position. Fig. 33 represents the controlled abdomen at the end of the inhalation. Here again Fig. 34 which gives a side view of this very position, affords a better idea. The Western physical culturists advise their followers to draw out the abdomen at the time of inhalation. In our opinion this is due to some wrong conceptions about the physiology of deep breathing. They look to be under the impression that they can admit a larger quantity of fresh air and consequently of oxygen, if they were to draw out their abdomen. But in the laboratory evidence that we have collected in the Âśrama, we have found this to be an

1 In this and the following pictures given in this chapter, the position of the right hand on the nose does not refer to Ujjâyî. The photographs are intended to be of general use in illustrating positions in Prâṇâyâma.

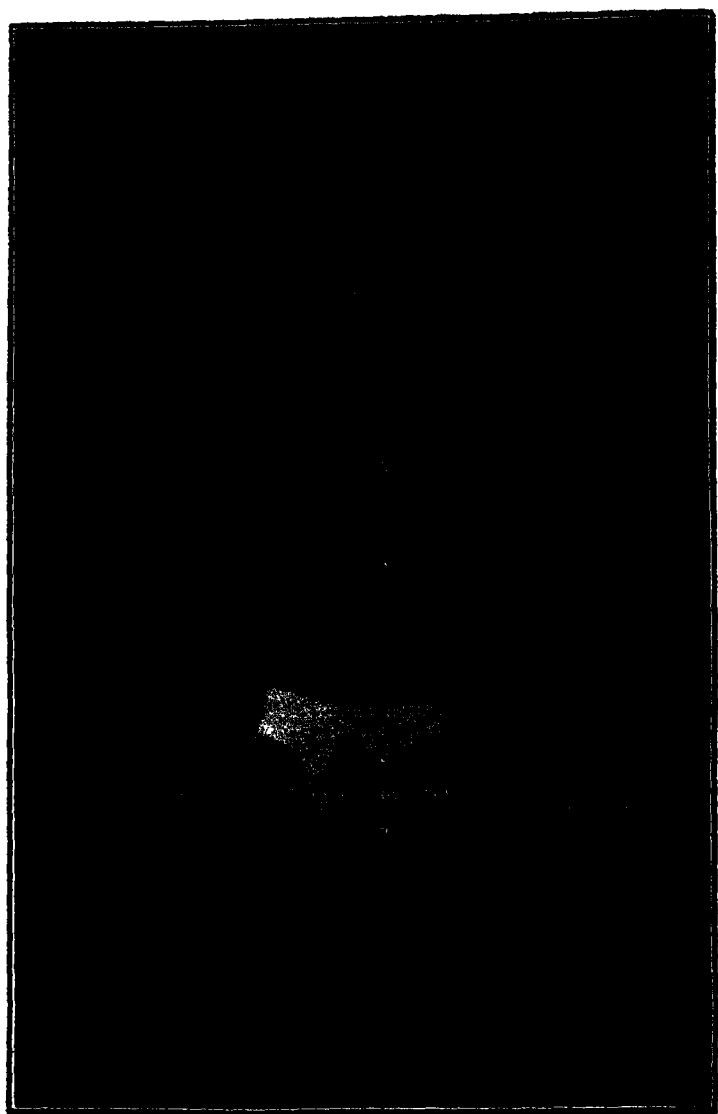



Fig. 31.— Starting Inhalation with Controlled Abdominal Muscles (*Front View*).

FIG. 32.—Starting Inhalation with Controlled Abdominal Muscles (*Side View*).

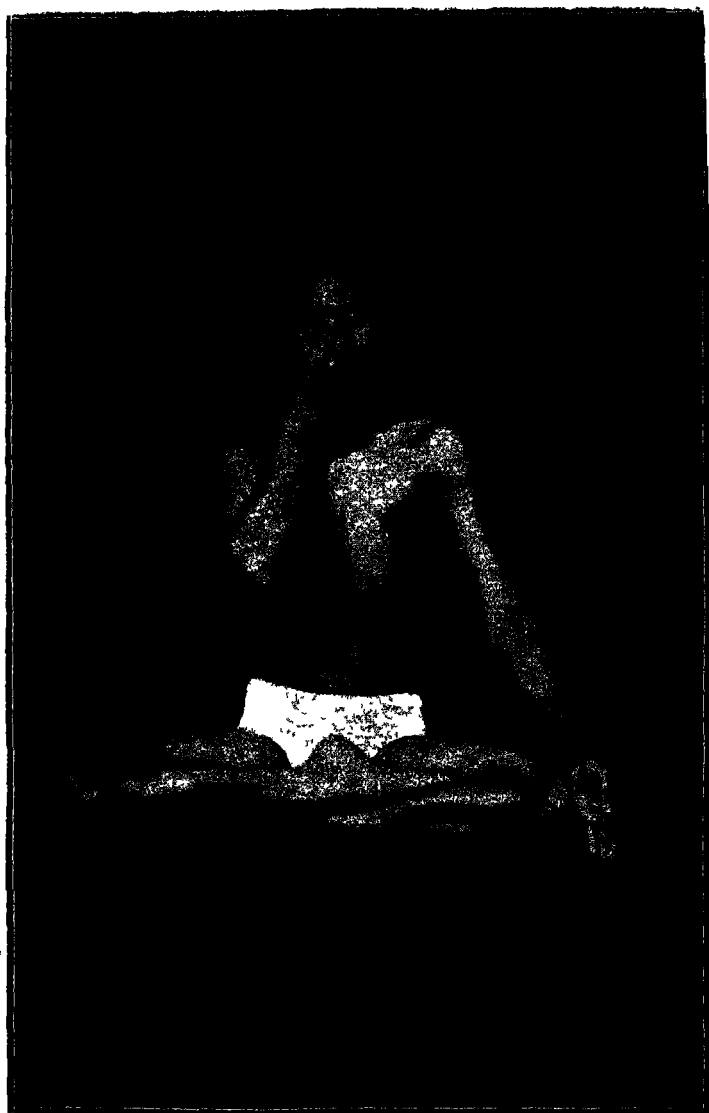



Fig. 33.—Full Inhalation with Controlled Abdominal Muscles (*Front View*).

Fig. 34.—Full Inhalation with Controlled Abdominal Muscles (*Side View*).

Fig. 35.—Full Inhalation with Protracted Abdomen.
(*Front View*)

Fig. 36.— Full Inhalation with Protracted Abdomen.
(Side View)

error of judgment. The fact is that the controlled abdomen allows at a time more oxyen to be inhaled than the protracted abdomen. So far as the culture of the nerves is concerned, controlled abdominal muscles have got a decided advantage over protracted abdominal muscles in which condition they are kept relaxed.[1]

We do not say Prâṇâyâma, but purposely use the word *deep breathing*. As will be discussed in the last chapter of this part of the present handbook, the physiological effects of Prâṇâyâma are vastly different from those of deep breathing. It is, therefore, wrong to use the two words as equivalents of each other. To illustrate full inhalation with protracted abdomen, we have given Fig. 35. Fig. 36 represents the side view of the same. A comparison between Figs. 34 and 36 will very vividly indicate the contrast between a controlled and a protracted abdomen.

The whole course of inhalation must be smooth and uniform. The accompanying sound due to the friction offered by the partially closed glottis, should also be of a low but sweet and uniform pitch. All friction in the nose, especially in the olfactory region, should be cautiously avoided. It is this friction that is very often responsible for the brain disorders at times arising from the wrong methods of Prâṇâyâma. When the limit of inhalation is reached there should be no convulsive effort at snatching an additional breath. No amount of muscle twisting will draw in even one more c.c. of air. As soon as the inhalation is completed, Kumbhaka should start.

1 For full and convincing information on this extremely vital point, read our article 'Ujjâyî Prâṇâyâma Explained' in *Yoga-Mîmâṅsâ*, Vol. IV.

KUMBHAKA :—

Out of the various types of Kumbhakas referred to in the preceding chapter, Ujjâyî requires Âbhyantara Kumbhaka, that is, Kumbhaka practised after deep inhalation. The first thing that demands our *attention* in this Kumbhaka is the complete closure of the glottis. This thoroughly shuts off the passage to and from the lungs. The second thing is the practice of Jâlandhara-Bandha (vide p. 34), and the third is the shutting of the nostrils. The tightly closed glottis establishes the first and the most effective line of defence against the inspired air that constantly tries to break through the air passage during the interval of Kumbhaka. Jâlandhara-Bandha by thoroughly contracting the oral pharynx offers the second line of defence. The third line of defence requires no explanation. It is to be noted that when the first line fails, the second and third lines are not able to successfully withstand the onset of the air. Nor is it desirable to attempt any such thing, because such an effort is likely to lead to untoward consequences. The second and third lines are there, only to support the first line in its work.

It is to be borne in mind that the glottis will be able to do its work only so long as the walls of the chest stand firm with the elevated ribs. So the contraction of the muscles of inspiration secured at the end of inhalation, is to be maintained throughout Kumbhaka.

The slight contraction of the abdomen is to be carefully maintained. As will be shown in the last chapter

of this part of the present handbook, the real advantage of Kumbhaka lies in this abdominal contraction. Here we must make a brief reference to the popular belief according to which the real advantage of Kumbhaka consists in the larger quantities of oxygen being absorbed into the system, on account of the retention of air in the lungs. We have conducted laboratory experiments to test the truth of this belief; and we have found that there is not much truth in it.[1]

The time limit of Kumbhaka should be made to depend upon two things. (*1*) While Kumbhaka lasts no serious sense of suffocation should be experienced. (*2*) At the end of Kumbhaka, the student must have as much control over his lungs as would make a smooth and proportionate Rechaka possible. If these conditions are attended to, there is no danger of damaging either the lungs or the heart, in the case of a man of average health.[2]

The time proportion between Pûraka and Kumbhaka is either 1 : 4 or 1 : 2 as stated in the last chapter. A beginner will do well to follow the latter. But whatever the proportion, the measure of Kumbhaka should first be determined as stated in the foregoing paragraph and then a proportionate time be fixed for Pûraka.

When Kumbhaka is to end first relieve the pressure from the left nostril, then unlock Jâlandhara-Bandha

1 The experiments referring to this point are being published in *Yoga Mîmâṅsâ*, Vol IV.

2 People suffering from pulmonary or cardiac disorders will do well not to practise Prâṇâyâma, and especially Kumbhaka, save under expert supervision.

and afterwards partially open the glottis. The thorax is to be relaxed only when the air passage is left open. With the relaxation of the chest, Rechaka starts.

RECHAKA :—

Rechaka is to be done through the left nostril. At no stage during Rechaka should the student lose his control over the lungs. The relaxation of the chest should be slow and uniformly progressive to the end. The glottis should all along remain partially closed. The frictional sound due to this partial closure, should be of a low but uniform pitch.

From the very beginning of Rechaka, the abdominal muscles undergo greater and greater contraction. Even when the chest shrinks to its lowest size, the abdomen should continue to contract, till at last the last c.c. of the supplemental air is expelled. Figs. 37 and 38 represent a thoroughly contracted abdomen. This does not mean that in Rechaka any amount of strain can be put upon the system. It only means that the exhalation should be as thorough as can be secured without involving any undue strain. Our readers may, however, note here that in Rechaka there is less possibility of unduly straining oneself than in Pûraka or Kumbhaka. There is another point of difference that deserves attention. In the case of an average man of health, Pûraka and Kumbhaka, if developed beyond the right proportion, are likely to damage the lungs more than the heart; whereas an unduly deep Rechaka is likely to affect the heart more than the lungs.[1]

---

1 For exhaustive explanation read 'Ujjâyi Prâṇâyama Explained' in *Yoga-Mimâṁsâ*, Vol. IV.

Fig. 37 — Full Exhalation (*Front View*).

Fig. 18.—Full Exhalation (*Side View*)

Rechaka should always take a longer time than Pûraka. The orthodox proportion between Pûraka and Rechaka is 1 : 2. An attempt should be made to reach this standard. Here again one has to bear in mind that Rechaka should never be so prolonged as to make the following inhalation any way hurried. In fact in fixing up the proportions of the three component parts of a Prâṇâyâma, that is, of Pûraka, Kumbhaka and Rechaka, one has to see that one can perform with comfort, not only one Prâṇâyâma, but all the successive Prâṇâyâmas also. If at a sitting one wants to go through, say, fourteen rounds of Ujjâyî, one should never feel the need of snatching a normal breath in between any two successive rounds, till all the rounds are finished. No undue sense of suffocation should be experienced at any stage in the practice of Prâṇâyâma, whatever the number of rounds that one wants to have at a time. So necessary care is to be taken not only in fixing up the component parts of a single round, but also in fixing up the total number of rounds one wants to go through at one sitting.

THE TOTAL DURATION OF A SINGLE ROUND :—

This will necessarily depend upon the capacity of every man. Without giving our reasons here, we may state the following rules.

(i) A spiritual culturist should try to prolong the duration of each round.

(ii) A physical culturist who looks to the oxygen value alone of the performance, should try to shorten the duration of each round.

(*iii*) A physical culturist who looks to the other values in addition to the oxygen value, should try to have four rounds a minute.

CONCENTRATION :—

A spiritual culturist should concentrate his attention upon that point in the nasal part of his pharynx where the first touch of the inhaled air is felt. This point is situated just behind the anterior openings of the nasal passages, in the dome of the nasal pharynx, directly above the top of the arch formed by the junction of the hard and soft palates. In exhalation the last touch of the exhaled air will be felt at this very point. Concentration on this point is to be maintained throughout Prâṇâyâma whether one is doing Pûraka, Kumbhaka or Rechaka.

A physical culturist should concentrate his attention upon the air he breathes. During inhalation and exhalation it should be marked at the glottis as it meets with friction there. During Kumbhaka the concentration should be on the air held in the chest.

In this connection there are many other points of importance both for the physical and spiritual culturists. But the scope of the present handbook precludes the possibility of any reference to them here.

GENERAL HINTS :—

As stated in the last chapter a beginner whether he is a physical culturist or a spiritual culturist, will do well to practise Ujjâyî without Kumbhaka. For the former

Kumbhaka is not necessary, unless he wants to perform such feats of strength as are exhibited by Prof. Râmamûrti and his imitators. Even for a spiritual culturist the need of Kumbhaka arises after a good deal of progress. At any rate a novice should avoid Kumbhaka for some days at least and when it is to be taken up, utmost care should be taken against undue strain.

There is another point which we shall recommend to our readers. Even in Ujjâyî, Rechaka may be practised with both the nostrils. We know that this change is not in keeping with the orthodox technique, but it will be found very convenient by beginners. Again we do not think that this change will much affect the expected results.

In case this recommendation is taken up and also that of dropping out Kumbhaka, there remains no need of using the right hand for closing the nostrils.

What should be the total number of rounds to be practised daily and how should these rounds be distributed ?

For a spiritual culturist the maximum number of rounds is 320 This is to be distributed over two to four sittings according to one's convenience. A physical culturist should satisfy himself with a total of 240 to be finished in two instalments. For him the morning and evening hours are the best.

By both the types of Yogic culturists, a beginning can be made with seven rounds at each instalment, add-

ing three rounds to each instalment per week. For several years we have found this to be a very safe programme, the same having been tried in thousands of cases.

The whole treatment accorded to the subject here, is from the point of view of an average man of health. People not suffering from any serious trouble either of the heart or of the lungs, can also follow these instructions with suitable changes. But any one suffering from a pulmonary or cardiac disorder, is strictly warned against taking to these practices on his own responsibility. He must consult an expert.

CHAPTER V

KAPÂLABHÂTI

THE NAME :—

The word Kapâlabhâti is a compound consisting of two members : Kapâla and Bhâti. In Sanskrita Kapâla means the *skull*, and Bhâti is derived from a Sanskrita root meaning *to shine*. Hence Kapâlabhâti means an *exercise that makes the skull shining*. Kapâlabhâti is one of the six cleansing processes, known in Haṭha Yoga as Shat Kriyâs[1], and is intended to clear the nasal passages *contained in the skull*, along with the remaining parts of the respiratory system. As the exercise necessarily cleanses a part[2] of the skull, the name Kapâlabhâti is appropriately given to it.

---

1 The following verse enumerates the six cleansing processes :—

धौतिर्बस्तिस्तथा नेतिस्त्राटकं नौलिकं तथा ।
कपालभातिश्चैतानि षट् कर्माणि प्रचक्षते ॥ H. P., II 22.

Out of these six, धौति (Vol. II, pp 170–177), बस्ति (Vol. I, pp. 101–104), and नौलि (Vol. I. pp. 25–26) have been treated at some length in the journal, *Yoga-Mîmâṁsâ*.

2 We are studying the physiology of Kapâlabhâti in our laboratory. The research work is yet far too incomplete to enable us to make a definite statement But the little work that has already been done in this connection, has led us to think that the exercise is capable of cleansing not only the respiratory system but also the different parts of the human anatomy connected with the skull. We have also reasons to believe that Kapâlabhâti is capable of cleansing even the capillaries of the remotest parts of the human body

In Yoga Śâstra[1] three different varieties of Kapâlabhâti have been mentioned. All these varieties are characterized in common by their capacity to cleanse the nasal passages contained in the skull. Here, however, we are going to notice the most popular variety of the lot. As will be seen from its technique, this variety is a type of breathing[2] exercise.

THE TECHNIQUE[3]:—

Although Kapâlabhâti is not[4] a Prâṇâyâma in the strictly technical sense of the word, it is surely a breathing exercise and as such all that is said about the place, the seat, the time etc., in the third chapter of this handbook applies as much to this exercise as to Prâṇâyâma proper. So the student should select his place, arrange his seat and fix his time according to the general instructions given in that chapter. The next question to be considered is about the posture appropriate to this exercise. A student of physical culture can assume any sitting posture that is convenient to him. We do

1 Vide *Gheraṇḍa-Saṁhitâ*, I 55

2 The other two varieties are performed with the help of water and constitute what we may call the Yogic nasal douches. In this connection it is to be noted that the technique of the variety discussed in the present handbook is different from the technique as it is given by the author of *Gheraṇḍa-Saṁhitâ* In writing this chapter, we have followed the author of *Haṭha-Pradîpikâ* The technique given in *Gheraṇḍa-Saṁhitâ* is of little practical value. Hence we have left it out of consideration here.

3 Readers wishing to practise Kapâlabhâti according to the technique given here, are earnestly requested to study carefully what we have written on respiration in the first chapter. This will enable them not only to grasp intelligently the different points of the present technique, but will help them to eliminate all possible errors from their practice of the exercise.

4 We will discuss this point later on in this very chapter.

not think that Kapâlabhâti can be advantageously practised in standing. As will be seen later on, this breathing exercise requires a very free movement of the abdominal muscles. Now the front abdominal muscles are not fully relaxed while one is standing, and as such cannot be freely manipulated. But while one is sitting these abdominal muscles can undergo complete relaxation and their movement can be thoroughly controlled in this position. Hence even a physical culturist will do well to practise Kapâlabhâti in a sitting posture.

The question of a spiritual culturist stands on a different footing. He is very strongly recommended the Lotus Pose (vide pp. 36-37), for the practice of Kapâlabhâti. The reason is this : Kapâlabhâti to be of any spiritual advantage, has to be practised vigorously and across a good length of time. A vigorous practice of Kapâlabhâti, even for a few minutes, makes almost every tissue in the human body vibrate. These vibrations become more and more violent if the exercise is pushed further with the original vigour, till at last it becomes very difficult to control the pose that one may have assumed. Now out of the meditative[1] poses that we have recommended to students of spiritual culture, Padmâsana is the only sitting pose that can keep the limbs of the student in their proper place under such circumstances. The principal question is of the lower extremities The foot-lock which forms part of the Padmâsana technique is so arranged that no amount of violence done to the legs can unlock it.

1 Siddha, Svastika and Sama are the other meditative poses recommended to a student of spiritual culture. For the physiology of these meditative poses read our article on the subject in *Yoga-Mimâńsâ*, Vol. III.

In other meditative poses, the legs are loose, and the violent jerks which the body begins to receive through vigorous Kapâlabhâti, soon throw them out of order. As it is essential that the pose once assumed is maintained intact throughout the exercise, Padmâsana is the only meditative pose available for the practice of Kapâlabhâti.

This traditional and rational teaching of Kapâlabhâti being practised in Padmâsana only, is supported by the author of *Haṭha-Pradîpika* We must admit that Svâtmârâma Sûri does not say in so many words that Padmâsana is obligatory for the practice of Kapâlabhâti; but we can know what he means from what he says in connection with Bhastrikâ. Whereas in the case of other Kumbhakas, Svâtmârâma does not mention any particular pose, in his description of the technique of the Bhastrikâ Kumbhaka he makes a special mention of Padmâsana.[1] This means that according to him the Bhastrikâ Kumbhaka *must* be practised in the Lotus Pose.[2] Now the exercise of Kapâlabhâti is so akin to Bhastrikâ, that we can safely say that Bhastrikâ[3] is equal to Kapâlabhâti plus a Kumbhaka of the Ujjâyî type That being the case we can logically conclude

1 His description of the technique of Bhastrikâ opens as follows —
सम्यक् पद्मासनं बद्ध्वा... ... ... । H P. II 59.
[Having satisfactorily taken the Lotus Pose...]

2 This very conclusion has been drawn by Svâtmârâma's commentator Brahmananda. The latter says:—भस्त्राकुम्भकस्य पद्मासनपूर्वकमेवानुष्ठानात्तदादौ पद्मासनमाह । [The author describes the Lotus Pose before giving the technique of the Bhastrâ (the same as Bhastrikâ) Kumbhaka, because that pose is obligatory for that type of Kumbhaka.]

3 Our readers will better understand this statement when they will have read the next chapter which discusses the technique of Bhastrikâ.

that the Âsana which is obligatory for Bhastrikâ is also obligatory for Kapâlabhâti.[1]

It is to be remembered in this connection that the Lotus Pose to be assumed for Kapâlabhâti mainly consists of the foot-lock.[2] The position of the hands may, as usual, be either on the knees forming Jn'âna-Mudrâ, or they may be arranged in front of the abdomen as required in Padmâsana. Regarding the two Bandhas, namely, Jâlandhara and Mûla, which ordinarily form part of Padmâsana, the following instructions may be attended to.

In breathing exercises Jâlandhra-Bandha has to be practised during the period of Kumbhaka.[3] Kapâla-

1 For the guidance of the practical students of Yoga we may mention here that even for spiritual purposes Kapâlabhâti may be practised in some other meditative pose, provided it is not done so vigorously nor for so long a time as to induce violent jerks. There are many people who find it very difficult, if not altogether impossible, to have the foot-lock formed. These need not forego the practice of Kapâlabhâti simply because they cannot carry out this part of its technique. They may assume any comfortable sitting posture for this exercise.

2 What we say will be clear when we read Svâtmârâma's description of Padmasana when it is taken for Bhastrikâ. He talks there of the foot-lock and nothing else.

ऊर्वोरुपरि संस्थाप्य शुभे पादतले उभे ।

पद्मासनं भवेदेतत् ... ... ॥ H. P., II 58

[The Lotus Pose is secured when the feet with their clean soles upturned are arranged on the thighs......]

3 There is only one exception to this general rule. That exception is to be found in the technique of the Mûrchchhâ Kumbhaka (Kumbhaka for rendering the mind passive) This Kumbhikâ (feminine of Kumbhaka), requires the expulsion of breath to be done with a Chin-Lock.

Cf. पूरकान्ते गाढतरं बद्ध्वा जालंधरं शनैः ।

रेचयेन्मूर्च्छनाख्येयं ... ... ॥ H. P., II 68.

[In the Kumbhikâ called Mûrchchhanâ (the same as Mûrchchhâ), one should expire slowly while the Chin-Lock is very firmly secured after the completion of inspiration......]

bhâti is indeed a breathing exercise : but consisting as it does of incessant respiration exclusively, it does not include Kumbhaka. Hence the practice of Jâlandhara is not needed in the Lotus Pose when it is taken for Kapâlabhâti.

The other, namely, Mûla-Bandha is to be treated in a different way. Students of Yoga peculiarly susceptible to the vibrations set up by Kapâlabhâti, *involuntarily* form this Bandha, as the vibrations become more and more violent. The whole pelvic region is *automatically* contracted resulting in the vigorous contraction of the anal sphincters. Hence it is desirable that in the initial stage of the practice, the intentional formation of Mûla-Bandha is avoided. If it is found that the Kapâlabhâti vibrations do not automatically secure this Bandha, even when a Yogic student is well established in this exercise, Mûla-Bandha may be voluntarily introduced in the technique of this Kriyâ.

What has been said about the erect spine in the case of Ujjâyi equally applies to Kapâlabhâti.

Having dealt with the Âsana necessary for Kapâlabhâti, we now proceed to discuss the technique of the exercise proper.

Broadly speaking Kapâlabhâti is a breathing exercise of the abdominal[1] or diaphragmatic type in which sudden expulsions of breath follow one another in quick succession and which is characterized by the absence of any pause in the movement of breath so long as the exercise

1 For information on this point read the first chapter

continues. So this exercise consists of Rechaka and Pûraka only, Kumbhaka being done away with entirely. Again between Rechaka and Pûraka, Rechaka is the principal part of the practice, Pûraka, being only supplementary. In the case of Kapâlabhâti there is one more feature which deserves to be borne in mind. In other breathing exercises in Yoga, one Pûraka, one Kumbhaka and one Rechaka complete one round. But in Kapâlabhâti one round consists of as many expulsions of breath as one likes or is capable of performing. Thus one may have several hundred expulsions in a single round of Kapâlabhâti.

Let us now come to details and let us start with Rechaka which constitutes the main feature of the exercise.

RECHAKA :—

As in Ujjâyi so in any other breathing exercise, whether Eastern or Western, Rechaka and Pûraka are invariably advised to be very deep. In fact Rechaka is expected to be so complete that no additional c.c. of air could be further extracted from the lungs. So also Pûraka is expected to be so complete that no additional c.c. of air could be further introduced into the lungs. Kapâlabhâti, however, stands on a different level. It is the only[1] exercise which does not require very deep expiration or very deep inspiration. Then what is the volume of air that is to be expelled from the lungs in an expiratory attempt in

1 Also that part of Bhastrikâ which corresponds to Kapâlabhâti. It is to be noted, however, that Bhastrikâ as a Kumbhaka does require deepest possible Pûraka and Rechaka to precede and follow it

Kapâlabhâti? In every Rechaka in Kapâlabhâti only as much air is to be exhaled as can be driven out of the lungs by a sudden and vigorous inward stroke of the front abdominal muscles. Naturally this amount of air will be different for different individuals. We have conducted experiments in our laboratory to measure these amounts for different subjects and also to compare these with the respective amounts of their normally exhaled air. On the strength of this evidence we can say that in Kapâlabhâti the exhalation should be a little deeper than in ordinary breathing. For example, if the volume of the normally expired air in the case of an individual, is 480 c.c., he is expected to exhale about 600 c.c. in an expulsion in Kapâlabhâti.[1]

The essence of Rechaka, however, does not consist in regulating the volume of the expired air, but it lies in a definite arrangement of the different anatomical parts especially those that are directly involved in breathing. It has already been stated above that Kapâlabhâti is an exercise in abdominal breathing. Hence in this exercise exhalation is effected more by the movements of the front abdominal muscles and the diaphragm than by the movements of muscles acting on and between the ribs. In fact the muscles that act on and between the ribs are kept contracted as long as a particular round of Kapâlabhâti lasts, whatever the number of expulsions that go

1 We know that these mathematical values of the expired air are of little help to a practical student of Yoga In everyday practice the following rule of thumb will be sufficient Let the abdominal stroke be complete and let the breath flow out easily When this is done the volume of the expired air will take care of itself.

Fig. 39.—Abdomen and Thorax at the End of Pûraka in Kapâlabhati.

Fig. 10.—Abdomen and Thorax at the End of Rechaka in Kapâlabhati

to form that round. In other types of breathing exercises in Yoga, these muscles remain contracted only in Pûraka and Kumbhaka. As soon as Rechaka begins they are relaxed, the relaxation being complete when Rechaka is the deepest. But in Kapâlabhâti, owing to its peculiar character, the muscles acting on and between the ribs, once contracted, remain in the same condition, keeping the ribs raised even during expulsions of breath. The only muscles that freely move throughout the exercise, undergoing alternate contraction and relaxation, are the diaphragm and the front abdominal muscles. This should not be interpreted to mean, that the ribs do not sink *at all* during exhalation in Kapâlabhâti. As a matter of fact it is impossible to exhale without a little lowering of the ribs. But the falling of the ribs is so little in a well conducted exercise of Kapâlabhâti that it is almost negligible. This can be verified by the external appearance of the thorax. It neither rises nor falls appreciably throughout a round of Kapâlabhâti. (For the position of the thorax and the abdomen compare Figs. 39 and 40).

The exercise of Kapâlabhâti, as stated above, is a play of the abdominal muscles and the diaphragm. These must be thoroughly supple and capable of undergoing sudden and vigorous contractions. In the Rechaka of Kapâlabhâti, the front abdominal muscles are suddenly and vigorously contracted giving an inward push to the abdominal viscera which in their turn move upward pushing up the relaxing diaphragm that recedes into the thorax expelling a volume of air from the lungs. As the retracting lungs are not allowed to contract the

thorax, expiration in Kapâlabhâti is not as deep as in Ujjâyî. The speed with which the diaphragm and the abdominal muscles can be manipulated will depend upon one's practice. It is not desirable, however, to develop speed at the cost of thoroughness.

Up to now we have discussed the work to be done with the abdomen and the thorax in Kapâlabhâti. We now proceed to see how the respiratory passage outside the thorax is to be worked.

In Ujjâyî we are required to close the glottis partially. In the present exercise this is to be avoided. The reason is clear. The volume of air exhaled in a single Rechaka of Kapâlabhâti is so suddenly expelled, that a partially closed glottis would afford serious obstruction to the passage of the air and would render the expiration incomplete. There is one tradition[1], however, which would wish very slight narrowing of the glottis even in Kapâlabhâti. But the extent to which this is to be done is so small that the expelled air is not likely to be held back to any appreciable extent.

When the expelled air is allowed to escape freely through the glottis, it has a smooth though rapid passage to the end of the nostrils. If permitted to do their work automatically, the nostrils will open out voluntarily to facilitate the flow of the expired air. So the student of Yoga should not try to manage either his nostrils or his facial muscles at this stage. Very often people are in the habit of having all sorts of ugly con-

1 This is the tradition followed by the author of *Haṭha-Pradîpikâ*

tortions of their face when they are practising Kapâlabhâti. This is far from being desirable. The air should be permitted to have a very smooth escape which it would surely have if allowed to go its own way.

It is to be remembered, however, that the rapid expulsion of a volume of air will surely cause some friction at the lower end of the nostrils. But this does not matter. As our readers know this part of the internal nose is covered with thick skin and any friction there is not likely to lead to any untoward results. What is to be cautiously avoided is the friction of the air with any of the delicate parts of the mucous membrane that lines the interior of the nasal passages.

PÛRAKA :—

In order to get a clear grasp of the process of Pûraka in Kapâlabhâti, it is desirable for our readers to refresh their memory regarding a few facts about normal respiration. Normally the process of inhalation is active whereas the process of exhalation is passive. In normal inspiration the thorax is to be opened out for increasing its internal capacity, so that its lowered internal pressure might draw in air from outside. Thus the muscles that act on and between the ribs, so also the diaphragm, are put into action and contracted, raising the former and lowering the latter. But normal expiration is only a passive process. The muscles referred to just now are relaxed. Consequently the ribs sink down of themselves and the diaphragm is drawn up by the retracting lungs that voluntarily shrink

owing to their elastic recoil. It is only on the side of the anterior abdominal muscles that things are a little different. These muscles are active in normal expiration and passive in normal inspiration, because during expiration they contract and during inspiration they stand relaxed. Thus their role in respiration is just the opposite of the one played by the thoracic muscles.

Now let us return to the process of Pûraka in Kapâlabhâti.

As noted above the exercise of Kapâlabhâti is a play of the abdominal muscles. The muscles of the thorax are kept contracted throughout the exercise whether it is inhalation that is being practised or exhalation. The thoracic muscles are relaxed only when the exercise is over. It is only the front abdominal muscles that keep on moving to and fro, according as they are contracted for exhalation or relaxed for inhalation. We shall presently consider the case of the diaphragm.

Thus Kapâlabhâti being markedly an exercise in abdominal breathing, one has to pay attention only to his abdominal muscles. At the end of Rechaka these muscles stand contracted. So in Pûraka one has simply to withdraw his control of these muscles and they will relax of themselves. Relaxation of muscles is a passive act. So when the abdominal muscles are let go at the end of Rechaka, they will voluntarily relax.

Up to now we have left out of consideration one important muscle, the diaphragm. Up to a particular

extent the manipulation of this muscle is entirely under the control of our will. But this muscle does not require the exercise of our will for its ordinary movements, just as the other respiratory muscles go on doing their ordinary work, without any attention on our part. While we are deeply absorbed in some work, these respiratory muscles are functioning even without entering into our consciousness.

Now at the end of Rechaka the diaphragm stands relaxed, but ready for another contraction. The stimulus from the inspiratory centre brings about this contraction and the descent of the diaphragm is allowed by the relaxing abdominal muscles. The lowering of the diaphragm increases the vertical diameter of the thorax, the internal pulmonary capacity is increased, and the internal pressure being lowered, the external air moves in, till the air expelled in Rechaka is replaced, raising the intra-pulmonic pressure to one atmosphere.

Thus it will be clear that in Pûraka no wilful contraction of muscles is necessary. One has simply to relax his abdominal muscles and Pûraka is performed. That is why we have said that Pûraka in Kapâlabhâti is a passive act.

There is a sharp contrast between the Rechaka process and the Pûraka process in Kapâlabhâti. The former is sudden and vigorous, the latter smooth and quiet. In fact Pûraka in Kapâlabhâti is there only to provide air for the next expulsion which alone forms the real part of the exercise.

The volume of air inhaled in a single Pûraka must be for all practical purposes equal to the volume of air exhaled in the previous expulsion. The student of Kapâlabhâti has, however, to remember that the time taken for one Pûraka is not the same as the time taken for one Rechaka. If we suppose that one Rechaka and one Pûraka taken together require half a second, it may be roughly stated, that Rechaka would occupy only one-fourth of this total time, Pûraka occupying the remaining three-fourths. In Pûraka the whole respiratory passage is kept fully open, there being no narrowing of it either at the glottis or any other part. Hence air glides smoothly into the lungs, we might say *almost*[1] as smoothly as in normal inspiration.

Rechaka and Pûraka are performed in a quick succession, no time being allowed to go by in between any two acts till a round is completed. Pûraka follows Rechaka and Rechaka follows Pûraka without a break All the while the noisy and sudden Rechaka is so much in evidence that the smooth and quiet Pûraka sinks into nothingness. So in practice, Kapâlabhâti appears to be an exercise of successive and sudden expulsions only. Each expulsion is preceded by a relaxation of the ab-

1 The minimum time taken up by an ordinary inspiration is nearly *a second and a half*, whereas inspiration in Kapâlabhâti, at an average speed of 120 expulsions per minute, requires only *three-eighths* of a second. Again the volume of air inhaled in Kapalabhâti is slightly larger than that inhaled in ordinary inspiration. Hence we find that the volume of air passing through the respiratory passage *during a particular unit of time* is far larger in Kapâlabhâti than in ordinary inspiration. Hence inhalation in Kapâlabhâti cannot be as smooth as normal inhalation. Still experience will show that Pûraka in Kapâlabhâti is smooth enough, and there is no roughness about it, corresponding to one evidenced in Rechaka.

domen and is accompanied by a sudden and vigorous inward stroke of it. The incessant blowing at the nose accompanied by the alternate rise and fall of the abdomen, give the exercise an appearance of the bellows of a village smith. In fact that is the simile given by the author of *Haṭha-Pradipıkâ* to illustrate the action of Kapâlabhâtı.[1]

A SINGLE ROUND IN KAPÂLABHÂTI :—

Up to this time we have considered the technique of an individual exhalation and an individual inhalation in Kapâlabhâti. Now we wish to discuss the measure of a single round of Kapâlabhâti and also to see how that round should begin and end.

In determining the measure of a round, we have to determine the number of expulsions that go to form one round and the speed with which these expulsions are performed. The question of speed we shall take up later on. First we shall say something about the number of expulsions. In this connection we can follow the golden rule laid down by an old Saṅskṛita proverb[2] according to which a humble beginning is always free from danger. The number of expulsions in

---

1 Svâtmârâma Sûri says —

भस्त्रावल्लोहकारस्य रेचपूरौ ससंभ्रमौ ।

कपालभातिर्विख्याता ... ... ॥ H. P., II 35.

[Hurried exhalations and inhalations after the fashion of an iron-smith's bellows, constitute the famous exercise of Kapâlabhâti......]

It is interesting to note here that Kapâlabhâtı plays such a prominent part in the Bhastrâ or Bhastrika Kumbhaka, that that Kumbhaka gets the very name of bellows. Bhastrâ or Bhastrikâ means bellows in Saṅskṛta.

2 अल्पारम्भः क्षेमकरः ।

each round which we prescribe to our patients[1] and even to students of physical or spiritual[2] culture is eleven to begin with. Generally three rounds are given at each sitting, two sittings being advised per day, one in the morning and the other in the evening. In normal cases eleven expulsions are added to each round every week, till at last each round consists of one hundred and twenty-one expulsions.

Every round should begin with an exhalation and should end with an inhalation. In between any two successive rounds normal respiration should be allowed to intervene. It will be found that this intervening respiration is unusually slow and smooth.[3] This period affords the rest necessary for the respiratory system in general and the abdominal muscles in particular. The length of this period should be settled according to one's own convenience. Generally speaking half a minute to one minute should be sufficient for preparing one for the next round. The dose of Kapâlabhâti prescribed in the last two paragraphs is perfectly general. It is intended for an average man of health and is sufficiently strong for bringing about the *physiological* results expected of this exercise. Those who feel themselves above the average, may have a larger measure of

1 Whether Kapâlabhâti can be prescribed to a particular patient and whether a change in this measure is indicated by the condition of his health are questions which cannot be detailed here. The discussion offered in these pages is from the point of view of an average man of health.

2 Although Kapâlabhâti is not a Pranayamic exercise, it is of considerable spiritual value.

3 A general explanation of this phenomenon will be found in this chapter under *General Hints*.

Kapâlabhâti in their daily practice. For the purposes of physical culture, we might recommend double the average dose as the maximum. This doubling may be secured either by doubling the expulsions in each round, keeping the number of rounds constant; or by doubling the number of rounds, keeping the number of expulsions in each round constant. Needless to say that the latter course will put less strain on the system than the former. The need of a spiritual culturist is greater. He may have, for his maximum dose, three rounds of three minutes each, at a sitting. It is *absolutely necessary, however, that in reaching this maximum no undue strain is put upon the system.* To be spiritually useful, the practice should set up the vibrations to which we have made reference in discussing the propriety of the Lotus Pose in this exercise.[1] These vibrations are set up only after *prolonged* rounds. Hence a spiritual culturist should distribute his total measure of the Kapâlabhâti exercise in as small a number of rounds as possible. Even in doing this the question of undue strain should never be lost sight of.

CONCENTRATION :—

The question of concentration is of supreme importance to a student of spiritual culture in his practice of Kapâlabhâti. With every expulsion of breath, he is delivering inward strokes upon the abdominal viscera. He is to think that these strokes are being delivered against a centre in the lower abdomen in which spiritual

1 Vide pp. 81–82.

energy[1] is stored up. This concentration, if maintained throughout the exercise, will enable a student[2] to make some centre of his nervous system spiritually active.[3] Even during the period of rest that is taken in between two successive rounds, the spiritual culturist should entertain no other thought except the working up of the desired centre.[4]

The question of a physical culturist is comparatively simple. He should concentrate upon the expulsions, all the while realizing that he is eliminating very large quantities of carbon dioxide and absorbing into his system similarly[5] large quantities of oxygen. This is rendering

1 According to Yogic teachings, as stated in the second chapter, Kuṇḍalinî which represents spiritual energy is coiled up in the lower abdomen The concentration being prescribed is calculated to wake up this Kuṇḍalinî. We have purposely avoided any modern anatomical terms here, simply because we cannot venture any speculative theory in connection with Kuṇḍalinî.

2 We do not wish to raise false hopes. So we request every student of spiritual culture to remember constantly the following fact. The ability to awaken nerve centres of spiritual value, varies very widely with different individuals. One person may get a response from one of these centres with less than six months' active work, whereas another person may fail to get it even after six years' labour. So when one wants to embark on a voyage that leads to the land that is beyond all darkness, one should consider himself to be the least qualified of the spiritual aspirants and be prepared for the arduous task before him. This will avoid frequent disappointments and early clamouring for results, provided always that the aspirant has undying faith in the immortal teaching of Bhagavân S'rîkṛishna that no spiritual aspirant ever comes to grief.

3 This activity is experienced first in the form of *throbbing* and then in the form of *serene light* glowing at the particular centre

4 The concentration described in this paragraph is only one of the different concentrations available for Kapâlabhâti in spiritual culture. We cannot notice the other concentrations in this handbook for want of space.

5 Generally slightly larger than those of carbon dioxide eliminated.

his blood richer in quality and consequently he is re-building the tissues all over his body. These thoughts should accompany not only his expulsions but also his period of rest.

GENERAL HINTS:—

As an exercise of very great oxygen value, Kapâlabhâti has no parallel. Its nerve culture value is also very great. Its effects upon the circulatory and digestive systems are of considerable physiological importance. The massage of the abdominal viscera which the exercise effects is obvious. The massage of other anatomical parts though not so clear to an untrained eye, is not of lesser consequence. Even this bare statement of the physiological importance of this exercise should be sufficient to prove that the exercise deserves a definite place in the daily physical culture programme of every man that cares for his health.

All the physiological advantages enumerated in the last paragraph accrue also to a student of spiritual culture. But he practises Kapâlabhâti for these advantages only up to a particular stage[1] of development. Afterwards Kapâlabhâti is practised by him for nerve culture and especially for awakening particular nerve centres of spiritual significance.

1 As stated in the beginning of this chapter Kapâlabhâti is one of the six cleansing processes advised in Yoga for securing what is technically called Nâḍis'uddhi, that is, the physiological balance necessary for spiritual development. Nâḍis'uddhi literally means the purification of nerves. This attainment of Nâḍis'uddhi indicates the stage where Kapâlabhâti ceases to be practised for physiological advantages by a spiritual culturist.

There is, however, another way in which a spiritual culturist takes advantage of Kapâlabhâti for his higher development. He uses Kapâlabhâti for enabling him to practise his Prâṇâyâma more efficiently. We shall now state briefly how this is done. The exercise of Kapâlabhâti leads to the elimination of carbon dioxide from the system on a very large scale. The absorption of oxygen into the system is also abnormally large. This extraordinarily heavy exchange of gases in the lungs brought about by Kapâlabhâti, soon gets the blood saturated with oxygen. The result is that the chemical stimulus to the respiratory centre[1] becomes weak and that centre becomes quiet.

It is a common experience of the students of Prâṇâyâma, that their attempts to control the lungs are seriously interfered with by the respiratory centre. A strong stimulus coming from this centre, makes hasty inspiration or expiration obligatory. If, however, the respiratory centre could be so quieted as to send out feeble impulses, if at all, the interference of this centre with our Pranayamic exercises would be the least, and we could manage the measure of our Pûraka, Kumbhaka and Rechaka as we pleased. This quieting of the respiratory centre is brought about by Kapâlabhâti in the manner explained in the last paragraph. That is why students of Prâṇâyâma are able to perform their Pranayamic exercises more efficiently, if they are prefixed by a few rounds of Kapâlabhâti. That is also why Yogic tradition requires a student of Yoga to practise

1 For information on this point read the first chapter.

Kapâlabhâti before starting with Prâṇâyâma proper,[1] in his daily course of exercises.

We cannot close this chapter without discussing the question of speed with which the exercise is to be gone through.

As a cautious measure one can start at the rate of one expulsion per second. This may be developed into two expulsions per second in due course of time. One hundred and twenty expulsions per minute should be considered to be a fairly good speed for an average man of health. Those that feel themselves to be above the average may develop two hundred expulsions per minute. To exceed this limit would be physically impossible, because then the expirations begin to be so shallow that the exercise would lose all its efficacy. A tolerably good speed is essential for Kapâlabhâti to be spiritually useful.

The vigour of expulsions is a thing to be constantly attended to. Any attempt to develop speed at the cost of vigour is in the wrong direction.

The degree of vigour and speed, the measure of a single round, the number of rounds to be done at one sitting and the total amount of exercise to be done in a day, are things which should be cautiously and judicially determined. Kapâlabhâti is a vigorous exercise and

1 It is to be remembered that students of spiritual culture practise Prāṇāyāma for the culture of their nerves. This is done by the manipulation of particular muscles, especially the diaphragm. Therefore these students want to be free to manage their diaphragm as they please. This they are able to do when interference from the respiratory centre is *largely* eliminated

therefore less innocent than Ujjâyî. Hence the necessity of being very careful in getting the right sort of dose. We shall close this chapter by repeating here what we have said at the end of the preceding chapter.

The whole treatment accorded to the subject here, is from the point of view of an average man of health. People not suffering from any serious trouble either of the heart or of the lungs, can also follow these instructions with suitable changes. But any one suffering from a pulmonary or cardiac disorder, is strictly warned against taking to these practices on his own responsibility. He must consult an expert.

CHAPTER VI

BHASTRIKÂ

THE NAME :—

By this time our readers have become familiar with the meaning of the word Prâṇâyâma.[1] They have also seen that Svâtmârâma Sûri, the reputed author of *Haṭha-Pradîpikâ*, recognizes eight[2] varieties of Prâṇâyâma of which Bhastrikâ is one. A reference has already been made to the meaning[3] of the word Bhastrikâ and also to the technique[4] of it. In this chapter we shall study this Prâṇâyâma at some length.

In Sanskṛita Bhastrikâ means *bellows*. This Prâṇâyâma is called Bhastrikâ because it is characterised by incessant and quick expulsions of breath in all its varieties,[5] imitating the actively hissing bellows of a village smith. Whether in these expulsions both the nostrils are used as in the first two varieties, or only one nostril is used as in the last two varieties, is all immaterial, quick succession of forceful expirations is

1 Vide pp. 45-47

2 Vide p. 48

3 Vide foot-note 1, p. 93.

4 Vide p. 82.

5 There are as many as four varieties of this Prâṇâyâma. We are going to notice all of them in this chapter.

the most prominent feature of every type of Bhastrikâ. Hence[1] the name.

THE TECHNIQUE :—

Those of our readers that may have made themselves thoroughly familiar with the technique of Ujjâyî and Kapâlabhâti, will find almost nothing new to learn in the technique of Bhastrikâ, at least so far as the first two varieties are concerned. We shall presently see why this is so.

First Variety[2] :—The first part of this variety is completely identical with the exercise of Kapâlabhâti as it is described in the last chapter. The breathing is entirely abdominal, the ribs being raised and kept up in that condition by the continued contraction of the intercostals. Both the nostrils are used for forceful and quick expulsions of breath that follow one another in rapid succession. Inhalations are passive being brought about by the relaxation of the abdominal muscles. In fact this part of Bhastrikâ is nothing more than the practice of Kapâlabhâti.

---

1 Svâtmarama Sûri says —

पुनर्विरेचयेत्तद्वत्पूरयेच्च पुनः पुनः ।
यथैव लोहकारेण भस्त्रा वेगेन चाल्यते ॥ H. P., II 61.
तथैव स्वशरीरस्थं चालयेत्पवनं धिया ।
... ... ॥ H. P., II 62

[One should exhale again so also inhale again, doing the same repeatedly. Just as a blacksmith works his bellows actively, so should one move his physical breath with speed and attention]

2 This is the type of Bhastrikâ traditionally handed down to the Director of the *Kaivalyadhâma* and daily practised by the Sâdhakas of the Âs'rama. The author of *Gheraṇḍa Saṁhitâ* recommends this variety to the students of Yoga. Vide Lesson V, 75-77.

After a number of exhalations, this number[1] being determined by the strength of the individual practising Prâṇâyâma, deepest possible Pûraka is made as in the case of Ujjâyî. Air is inhaled through both the nostrils and the abdominal muscles are kept controlled. Only the partial closure of the glottis and the consequent frictional sound produced in inspiration are to be avoided. The glottis is to be kept fully open. The air is to be drawn in by *slowly* expanding the chest. The passage of the inspired air through the nose and throat is to be so gentle, that no friction is caused in any part of the respiratory tract. It is desirable that the process of Pûraka should cover at least eight seconds.

Pûraka is followed by Kumbhaka. The inspired air is retained by completely closing the glottis and by securing Jâlandhara-Bandha. The closing of the nostrils with the fingers as in Ujjâyî is necessary. In fact Kumbhaka in Bhastrikâ is to be practised exactly as Kumbhaka in Ujjâyî, the two Kumbhakas being thoroughly identical in every detail, including the control of the abdominal muscles.

Rechaka follows Kumbhaka. Except for the partial opening of the glottis and the resulting soft sound of a low pitch, Rechaka in Bhastrikâ is quite similar to Rechaka in Ujjâyî. As in Pûraka so in Rechaka,

---

1 In *Gheraṇḍa-Saṁhitâ* only twenty expulsions of breath have been advised.

In the cultural and curative work done in the Âśrama, we have found that the measures of Kapâlabhâti and Bhastrikâ agree with each other with wonderful accuracy. Also read the *General Hints* given at the end of this chapter

Bhastrikâ requires the glottis to be thoroughly open, so that the returning air from the lungs may smoothly glide by. We have already studied the technique of Rechaka in Ujjâyî. In Bhastrikâ the same steps are taken to start and to complete Rechaka. First the hold on the nostrils is removed,[1] then Jâlandhara-Bandha is unlocked, afterwards the glottis is thrown open, and lastly by a simultaneous contraction of the chest and abdomen the air is slowly sent out of the shrinking lungs.

The Pûraka and Rechaka that respectively and immediately precede and follow Kumbhaka in Bhastrikâ Prâṇâyâma, differ from those Pûrakas and Rechakas which succeed each other without the interruption of Kumbhaka and which form the first part of this exercise corresponding to the practice of Kapâlabhâti. Inhalations and exhalations that successively follow each other are shallow, but the inhalation and exhalation that immediately precedes and follows Kumbhaka are made the deepest possible of their type.

We shall now sum up this description of a single round of Bhastrikâ which consists of two parts, the first being exactly similar to Kapâlabhâti and the second roughly similar to Ujjâyî. The student begins with quick expulsions of breath following one another in rapid succession. When the necessary number of expulsions is done, the last expulsion is followed by deepest possible inhalation. After retaining his breath till he could do it comfortably, he exhales as deeply as possible. The

1 As will be stated later on the right hand removed from the nose is again to be placed on the right knee

end of this deep Rechaka completes one round of Bhastrikâ.

A few normal breaths and the student is again ready for another round of this Prâṇâyâma.

Regarding the relative measures of Pûraka, Kumbhaka and Rechaka forming the second part of Bhastrikâ Prâṇâyâma, and the absolute measure of Kumbhaka therein, what we have said in the chapter on Ujjâyî also holds good here.

The author of *Gheraṇḍa-Samhitâ* recommends three rounds of Bhastrikâ for a man to keep himself fit. In our Âśrama we follow this very recommendation and find that an average man of health can keep up his health for practising three rounds of Bhastrikâ daily.[1]

Second Variety[2] — We shall consider this variety in its two parts separately. Starting with the first part which corresponds to Kapâlabhâti, we notice that there is a difference in the arrangement of the glottis during respiration. The glottis is to be slightly contracted so that a frictional sound is produced while breath is expelled or taken in, but no substantial obstruction is offered to the passage

1 This is not to be interpreted to mean that an average man of health can always find himself fit simply for practising three rounds of Bhastrikâ every day. What our statement means is this. In a well-balanced scheme of Yogic exercises, three rounds of Bhastrikâ form a suitable item. Such a scheme was published in *Yoga-Mîmâṅsâ* a few years ago and is to be found in one of the appendices in this handbook. The scheme is being practised all over India by several Yogic culturists at the recommendation of the Âs'rama.

2 This variety is recommended by the author of *Haṭha-Pradîpikâ*.

of the air.[1] This slight contraction of the glottis once secured is to be maintained throughout this part of the exercise. Except for this difference, the first part of this type of Bhastrikâ is completely identical with Kapâlabhâti.[2]

---

1 Read foot-note on p. 88 and the paragraph to which it is appended.

2 In making this statement, we have followed the text of *Haṭha-Pradîpikâ* and not its commentary by Brahmânanda. The commentator is of opinion that even in the first part of this exercise only one nostril is to be used as will be described in the third and fourth varieties, and not both. We positively know that there are traditions in Southern India which conform to the descriptions of the third and fourth varieties of Bhastrikâ as noticed here and as recommended by Brahmananda in his commentary. But this does not mean that his interpretation of the original text is correct. We shall give our reasons in brief for our difference of opinion

The original text relating to inhalation and exhalation in the first part of Bhastrikâ runs as follows —

मुखं संयम्य यत्नेन प्राणं घ्राणेन रेचयेत् ॥ H. P., II 59.
वेगेन पूरयेच्चापि ... ...॥ H. P, II 60.

[Shut up your mouth. Make a forced expiration through the *nose* and then quickly inhale.]

Here the singular number of the word घ्राणेन has given an opportunity to the commentator to get support from the original text for his varieties of Bhastrikâ — the third and the fourth — which alone he recognizes. He explains घ्राणेन as घ्राणस्यैकतरेण रन्ध्रेण । [through one hole in the nose] Now Svâtmârâma Suri whenever he has to make a reference to *one* nostril or to both the nostrils either to be used alternately, invariably gives specific instructions to that effect. As any such instructions are absent here, we have to take घ्राणेन to mean *through the nose, that is, through both the nostrils*. The singular number of घ्राणेन need not present any difficulty, as Brahmânanda himself has explained that word elsewhere as *through both the nostrils* In commenting upon घ्राणेनैव occurring in Lesson II 53, he writes as follows : घ्राणेनैव नासिकयैवेत्यनेनोभाभ्यां नासापुटाभ्यां रेचकः कार्यं इत्युक्तम् ।

So we find that the original text describes the second variety of Bhastrikâ, but the commentator tries to find in that text descriptions of the third and the fourth varieties, simply because he advocates the latter two and does not favour the former.

There are additional arguments in support of the view we have taken. But we abstain from quoting them here

The measure[1] of expirations in the first part of this variety agrees *in toto* with the measure of expirations in the corresponding part of the preceding variety. With the last expulsion of breath the second part begins.

The second part of this variety is similar to the second part of the first variety except in one detail. Here the deep inhalation and exhalation which respectively precedes and follows Kumbhaka are done through one nostril only instead of through both the nostrils as in the previous case. The nostril to be used for inhalation is always the right, whereas that to be used for exhalation is invariably the opposite one. Thus after the last expulsion of breath completing the first part of the exercise, deepest possible inspiration is made through the right nostril. Breath is retained according to the technique given in the first variety and then it is driven out, the expiration again being as thorough as possible. Needless to say that in this part of the practice the right hand[2] will all along be on the nose to regulate the passage of air. With deepest exhalation after Kumbhaka one round is finished. In order to be ready for the next round, the right hand is returned to its original position on the knee and a few normal breaths are taken.

---

1 Svâtmârâma Sûri does not define this measure by putting a numerical restriction upon it. He is of opinion that the bodily strength of an individual should determine his or her measure in every case He says —

यदा श्रमो भवेद्देहे .. .. I H. P, II 62.

[When the physical frame is fatigued (the second part should start).]

2 For the exact position of the hand and use of fingers read the general instructions given in the third chapter, pp. 68–69.

Under the second variety, we have described only those features which distinguish it from the first. As all other features are entirely identical, for understanding them we refer our readers to what has been said about them under the first variety.

Third Variety :—Here again it is desirable to consider the variety in two parts, the first part corresponding to Kapâlabhâti and the second corresponding to Ujjâyî. The only difference in Kapâlabhâti and the first part of the third variety is that in Kapâlabhâti both the nostrils are used for the expulsion of breath, but in this variety of Bhastrikâ only one nostril is used. Naturally the other nostril is to be kept closed, this closing being effected by the fingers arranged as in the case of Ujjâyî. According to Brahmânanda for every odd round of Bhastrikâ the right nostril is to be used and for every even round the other. Thus breath will be expelled after the fashion of Kapâlabhâti through the right nostril in the first, third, fifth and every succeeding odd round of this Prâṇâyâma ; whereas the expirations will be done through the left nostril in the second, fourth, sixth and every even round that follows.

The second part of this variety corresponds exactly with the second part of the last variety, with only one exception. In the second variety the deep inspirations and expirations immediately preceding and following Kumbhaka are invariably done through the right and the left nostrils respectively. But in the third variety the deep inhalation is to be done through the right nostril in every odd round and through the left nostril in every

even round, the deep exhalation being effected invariably through the opposite nostril. Thus in the first, third, fifth and every succeeding odd round, the right nostril will be used for deep inhalation and the left for the deep exhalation, of course after the intermediate Kumbhaka. But in the second, fourth, sixth and every even round that follows, the left nostril will be used for deep inspiration and the opposite one for deep expiration.

In short the technique of the third variety can be described as follows. Incessant respirations are started through the right nostril, keeping closed the left. When the necessary[1] number of respirations is gone through, deep inspiration is made through the same nostril. After retaining breath according to one's measure, it is fully expelled through the left nostril. This completes the first round The second round commences with forceful expirations as in Kapâlabhâti, using for this work the same nostril that was used for the last deep expiration, namely, the left. After due respirations, deep inspiration is made through that very nostril. Breath is retained and let out thoroughly through the right nostril. This completes the second round. Thereafter every odd round resembles the first and every even round resembles the second.

As throughout this exercise, in the first as well as in the second part of it, either one or both the nostrils are required to be kept closed, the right hand is always kept on the nose but the left hand is allowed to be on the knee. The fixing up of the chest, the play of the abdominal muscles and the arrangement of the glottis, thoroughly conform to the technique of the first variety.

1 What number is necessary will be presently stated.

Regarding the number of expulsions constituting the first part of every round and the total number of rounds that an individual should perform every day, what we have said in this connection in the first variety also applies to this variety.[1]

Fourth Variety — In this variety the second part is the same as in the third; but the first part differs. Here the first part resembles the second part with two points of difference. In the first part, there is no Kumbhaka and breathing is not deep Otherwise the two parts are exactly similar. Thus if a particular nostril is used for inspiration, the opposite is used for expiration as is always done in the second part. In simple words the technique may be put down as follows.

Quick inspiration through the right nostril is immediately followed by quick expiration through the left nostril. This chain of incessant inspirations and expirations is prolonged till the individual feels healthily fatigued. That constitutes the first part of the first round. This is followed by the deepest possible inspiration through the right nostril, the necessary retention of breath and the final expiration through the left nostril, which completes the second part of that round and also the round itself. Then the second round commences with quick inspirations through the left[2] nostril, and expirations through the right. In the second part, Pûraka is done through the same nostril as in the first part, that is, through the left, and after

1 Also read the *General Hints* given at the end of this chapter.

2 The same through which Rechaka of the previous round was done.

due Kumbhaka, Rechaka is done through the right nostril.

As in the last variety so in this, the first round is a model for every succeeding odd rounds and the second for every succeeding even rounds.

What we have said about the measures of the first three varieties applies to this type of Bhastrikâ also.

If we examine all the varieties of Bhastrikâ we find that the first part consists of a quick succession of Rechakas and Pûrakas as in Kapâlabhâti and the other part consists of deep Pûraka, Kumbhaka and deep Rechaka as in Ujjâyi. That is why we have said that Bhastrikâ is equal to Kapâlabhâti plus Ujjâyî.

Kapâlabhati plays such a prominent part in Bhastrikâ that whatever we have said[1] regarding Âsana appropriate to Kapâlabhâti applies to this exercise also. Thus a physical culturist should practise Bhastrikâ while sitting and a spiritual culturist should always take the Lotus Pose throughout the practice of this Prâṇâyâma. While sitting in Padmâsana whether the hands are to be folded as is required by the technique of that posture or whether they are to rest on the knees forming what is called Jn'âna-Mudrâ, is left to the choice of the individual. It must be noted, however, that throughout the third and the fourth varieties and during the second part of the first and the second varieties, the right hand has to manage the nostrils and cannot keep company with the left which invariably enjoys the privileged position of

1 See the opening paragraphs of the technique of Kapalabhâti in the last chapter.

resting either on the knee or on the heels arranged in front of the abdomen. The two Bandhas, namely, Mûla and Jâlandhara have a place in the technique of this Prâṇâyâma as they form a part of Padmâsana. As regards the former we might at once say that instructions given for its formation etc., in Kapâlabhâti apply *in toto* to the case of Bhastrikâ. We have, however, pointed out that Jâlandhara-Bandha has no place in Kapâlabhâti for obvious reasons. The case of Bhastrikâ stands on a different footing. Being a Prâṇâyâma, it requires the use of the Chin-Lock at the time of Kumbhaka. It is to be remembered, however, that Mûla may be maintained throughout the succession of different rounds, but Jâlandhara is to be used at the time of Kumbhaka only, otherwise the neck is to be kept erect.

For knowing the place, seat, time etc., suitable to the practice of Bhastrikâ, we refer the readers to the third chapter.

CONCENTRATION :—

Concentration to be practised in Bhastrikâ does not differ from the one recommended under Kapâlabhâti for both the types of Yogic culture, spiritual as well as physical.

GENERAL HINTS :—

Something has already been said under each variety of Bhastrikâ regarding its average measure. The following discussion is intended to make this question of measure clearer to the readers and to suggest progressive arrangements for their choice.

We have laid down the following equation :—

Ujjâyî plus Kapâlabhâti is equal to Bhastrikâ. Does it mean that the exercise of Bhastrikâ can singly replace the two exercises of Ujjâyî and Kapâlabhâti? Yes, theoretically it can ; but in practice it is not desirable to do so. We shall consider the cases of physical and spiritual culturists separately.

In our discussion on Ujjâyi, we have advised a physical culturist to avoid Kumbhaka at least in the beginning. The same advice holds good even in regard to Bhastrikâ. So a beginner when he starts with Bhastrikâ as a measure of physical culture, starts without Kumbhaka, and will have eleven expulsions of breath followed by one deep inspiration and one deep expiration. Of these he will have three rounds. Thus in all there will be thirty-three expirations of Kapâlabhâti type and three deep inspirations and expirations of the Ujjâyî type, speaking roughly. These very inspirations and expirations can again be arranged in four rounds: three rounds of Kapâlabhâti of eleven expulsions each and one round of Ujjâyî of three breaths each. Now our experience has taught us that the three rounds of Bhastrikâ put a greater strain on the system than the three rounds of Kapâlabhâti and one round of Ujjâyî put together. This statement may not appeal to one who examines these exercises on a smaller scale, but when they are compared on a larger scale the truth of it becomes at once evident.

Further our readers may recall what has been stated in the last but one paragraph of the preceding chapter. There we have said that as a breathing exercise Kapâla-

bhâti is less innocent than Ujjâyî. But if Kapâlabhâti is less innocent than Ujjâyî, Bhastrikâ is much less innocent that way. Hence we should strongly advise a beginner first to start with lessons in Ujjâyî alone. When he is practised to it a little and finds the same comfortable, he should add Kapâlabhâti to his programme of the Yogic exercises. He might think of practising Bhastrikâ only when he becomes capable of taking up Kumbhaka. Here again we would advise a cautious arrangement. The three rounds of Kapâlabhâti may give place to three rounds of Bhastrikâ to begin with. Afterwards as the practice develops, the first part of Bhastrikâ may be broken up into convenient groups of sixty, forty, thirty and twenty each, every group being followed by the second part. Thus each round of Bhastrikâ will be broken up into 2, 3, 4 and ultimately into six rounds. While laying down the measure of Kapâlabhâti, we have recommended six rounds of it as the maximum for any physical culturist. Now if each round of Kapâlabhâti is substituted by six rounds of Bhastrikâ, the total number of Bhastrikâ rounds amounts to thirty-six. We are sure this is more than sufficient for the needs of any student of physical culture.

When the rounds of Bhastrikâ in the daily scheme of exercises exceed nine, it is desirable that the rounds of Ujjâyî are proportionately lessened. And when the maximum of thirty-six rounds is attained in Bhastrikâ, Ujjâyî is dropped altogether.[1]

---

1 What has been said in this and the preceding paragraphs is intended to give the readers a general idea regarding the adjustment of breathing exercises It is not meant to lay down any hard and fast rules. It may be pointed out here again, that Bhastrikâ with twenty expirations is recommended by the author of *Gheraṇḍa-Saṁhitâ*.

The needs of a spiritual culturist are always greater than those of a physical culturist, so far as the Yogic exercises of spiritual value are concerned. Bhastrikâ is emphatically an exercise of that nature. Hence Yogic students of spiritual culture require a larger measure of Bhastrikâ than the one that is recommended above.

In discussing the spiritual measure of Kapâlabhâti, we have advised three rounds of three minutes each. Now when a spiritual student takes to Bhastrikâ, he should progressively break up those three rounds into six rounds each, so that the total number of Bhastrikâ rounds would be eighteen at a sitting. If the student stands in need of a larger dose of Bhastrikâ for the day, he should not subdivide the eighteen rounds any more; but should add to these rounds or should have a larger number of sittings in the day. In arranging for this extra dose of Bhastrikâ students should never fail to consult an expert whom they may have chosen as their guide.

Out of the eight varieties of Prâṇâyâma, Bhastrikâ has been mentioned as peculiarly capable of rousing the spiritual force. This Prâṇâyâma best prepares the mind for Pratyâhâra, Dhâraṇâ, etc. It is a wonderful exercise for lifting the individual above his flesh, and for bringing him face to face with the serene spiritual light. Practise Bhastrikâ religiously for a few months and the ecstatic joys of a Yogin are yours. Do not allow your enthusiasm to get the better of your reason, however, ever remembering the cautions pronounced at the end of the last two chapters.

CHAPTER VII

PHYSIOLOGICAL AND SPIRITUAL VALUES OF PRÂṆÂYÂMA[1]

IN the first chapter we studied the physiology of normal respiration. In the second we noticed the different poses etc., an individual has to assume, when he tried to educate his respiratory system through Pranayamic exercises, with a view to attain physical or spiritual excellence. In the third chapter we passed under rapid survey some of the most salient features of Prâṇâyâma in general, particular Prâṇâyâmas, namely, Ujjâyî and Bhastrikâ being studied in some detail in the next three chapters. In this last chapter of the present handbook, we wish to evaluate Prâṇâyâma from the physiological and spiritual points of view. First we shall ascertain its physiological value and then the spiritual.

The physiological value of an exercise depends upon its capacity to confer health upon the person practising it. The greater the degree of health an exercise is calculated to induce, the more valuable it will be. But what is health? Health

1 We have tried to write this chapter in as popular a language as the subject allowed it We have not, however, sacrificed scientific accuracy but as a result of our attempt to make things simple many statements have remained scientifically incomplete. To give one example out of many. In our discussion about the organs of elimination we have made no reference to the skin which is, perhaps, as important as the other three organs which have been mentioned therein. Our readers are, therefore, requested not to expect scientific completeness in this chapter, but should turn to *Yoga-Mimâṁsâ* for satisfying their desire.

may be defined as the harmonious functioning of the different systems working in the human body. The principal systems are the nervous, the glandular, the respiratory, the circulatory and the digestive. Out of these the nervous and the glandular are of supreme importance, but even they have to depend upon the other systems enumerated here. We shall now proceed to see how many and in what way and to what degree, Prāṇāyāma is able to influence these systems and secure their efficient and harmonious working. But before we do this we shall take a brief note of the functions of the different systems under discussion

Starting with the nervous system, we may compare it to a big power house generating electricity and the network of wires that distributes it to different areas. The brain is the power house. The nerves starting from the brain itself, the spinal cord which is the tail of the brain and the different individual nerves that arise from the spinal cord, all of these represent the electric wires in the human body. The machinery, whether stationary or moving, such as a big spinning and weaving mill, or the electric trains or tram-cars, is set in motion by the electric current carried across the wires from the power house. Similarly the physical movement of a human being, whether in motion or otherwise, all depend upon the impulses carried across the nerves from the brain. Let the power house go out of order or let there be obstruction in the current of electricity flowing across the wires, the whole machinery will come to a standstill. Similarly if the brain is deranged or the nerves are so degenerated as not to convey the impulses, physical movements will stop. This cessation of physical movements has a deeper meaning than an ordinary

reader can imagine. Our digestion, our blood circulation and even our respiration is controlled and carried on by the nervous impulses brought to the organs responsible for these functions, from the brain. In case the nervous impulses do not start or having started do not reach their destination, all life processes will stop, and even the spark of life may become extinct. Such is the supreme importance of the nervous system.

Now in the illustration of the power house taken in the previous paragraph, if the power house does generate electricity, and the wires conduct that electricity to their terminals, but if the current of electricity is not of sufficient strength, the machinery supplied by that electricity will not move. For the necessary movement the electric current must be of the required strength. In the machinery of the human body this strength of the current depends upon the secretions of what are called the endocrine glands. The whole nervous mechanism may be in perfect order, and yet if the endocrine secretions are not available in the necessary quantity and of the necessary quality, the strength of the nerve impulse and the nerves themselves later on will degenerate. Consequently physical movements and the life processes will become dull and languid. Let us take one of these glands for illustration, say the thyroid. This is the most popularly known endocrine gland, although the sex glands both in males and females, the pituitary body etc., are of no less importance. Remove the thyroid from a healthy person and his eyes begin to be pale, his cheeks begin to sink, his muscles begin to be flabby or lean, his hair begin to turn gray and he becomes a prey to premature old age. Restore the thyroid and the man begins to show all the signs of youthful enthusiasm. Symptoms of old age are gone,

the fellow begins to walk erect, things brighten and life again becomes a pleasure. Thus it will be seen that the glandular system stands on the same level of physiological importance as the nervous system.

Study of human physiology clearly indicates that these two systems of infinite importance in the human organism have to depend upon the circulatory system for getting the necessary blood supply and upon the respiratory and the digestive systems for getting the blood of the necessary quality. The circulatory system consists of the heart, the arteries, the veins and the capillaries. It is the duty of this system to take the blood to every tissue in the human body. The nerves and the endocrine glands, if they are starved for want of the necessary blood supply, will degenerate in their functions. The result will be what has been stated in the last two paragraphs.

It is, however, of no practical use to have the circulatory system in an efficient condition, if the quality of the blood that is being circulated through it is not rich. If the blood is loaded with toxins, the efficiency of the circulatory system will be of little consequence So the quality of the blood must be kept rich, and for this human physiology has to depend upon the respiratory and the digestive systems.

In order that the blood may be rich in quality, it must carry the necessary quantity of oxygen with it and also contain elements of nutrition for the tissues. The blood gets oxygen from the air inhaled and the elements of nutrition from the assimilation of food-stuffs and drinks. The quantity of oxygen the blood can carry, will mainly depend upon the

efficiency of the respiratory system. With defective respiration the absorption of oxygen into the blood will be insufficient and the tissues supplied by the blood defficient in oxygen will be starved. So also one may use rich food-stuffs and luxuriant drinks, but if the digestive apparatus is not in order, there will be little assimilation and most of the stuff will be wasted, with the result that the blood will contain very small elements of nutrition Thus we see that the respiratory and the digestive systems must work efficiently if the blood supply is to be constantly kept of a rich quality.

A defective working of the respiratory and digestive systems not only keeps the blood poorer in quality for want of oxygen and nutritive elements, but it loads the blood with waste matter which is poisonous We shall explain this point further. Carbon dioxide is constantly manufactured in the body. The efficiently working circulatory system carries this poisonous gas to the lungs and there gets rid of it. But if the efficiency of this system suffers, this waste matter accumulates in the different tissues and there produces toxic effects. Similarly food-stuffs leave a very large wastage. It is for the bowels to throw it out. The smaller the degree of assimilation of food and drink, the larger is the wastage. And if the bowels which are anatomically included in the digestive tube, do not work efficiently, this waste matter remains lodged in the colon or even in the small intestine for several days, giving rise to highly dangerous toxins. These toxins get into the current of the blood through the walls of the bowels and poison the blood, the poisonous blood being circulated throughout the body, thus leading to the degeneration of the whole organism

We have seen in the previous paragraph how the lungs and the bowels act as organs of elimination. The kidneys are also organs of the same type. So many of waste products which are poisonous in nature, are driven out of the human organism with the urine. If the kidneys do not function satisfactorily these poisonous substances are held back and find a resting place especially in the different joints of the human body. People suffering from gout have invariably defective kidneys. Thus it is clear that the blood in order to be rich in quality has to depend upon the respiratory and the digestive systems and in order to be free from toxic elements, it has to depend upon the organs of elimination. In this way we have studied some of the broadest features of the most important physiological systems upon the harmonious functioning of which, human health depends. We shall now proceed to examine how Prâṇâyâma helps the efficient functioning of these systems.

Starting with the organs of elimination, we find that the bowels and the kidneys are situated in the abdomen and the lungs in the chest. In normal respiration the alternate rise and fall of the diaphragm and the alternate contraction and relaxation of the abdominal muscles, give constant movement and gentle massage to the bowels and the kidneys. During Prâṇâyâma in both inspiration and expiration as well as in retention of breath, this movement and massage are greatly accentuated. If there be any congestion it is relieved for the pressure exerted. The nerves and muscles which control the functions of the bowels and the kidneys are all toned up. Thus the bowels and the kidneys derive benefit not only during the time that Prâṇâyâma is being practised, but even

for the remaining part of the day. The nerves and muscles once toned up continue to maintain that tone for a considerably long time. The bowels and the kidneys rendered healthier for Prâṇâyâma carry on their functions of elimination more effectively.

The same is the case with the lungs. As we have seen in the first chapter healthy respiration depends upon strong respiratory muscles and good elasticity of the lungs. Prâṇâyâma is a culture of these muscles and the lungs. By opening out the chest to its fullest extent several times a day and by putting the lungs on a stretch to the utmost possible extent, these organs are best educated to perform their functions satisfactorily. As in the case of bowels and kidneys so in the case of the lungs the training given to them for a short time, prepares them for an efficient working during the remaining part of the day. Thus Prâṇâyâma is a very valuable exercise for the organs of elimination.

Organs of assimilation do not stand on a different level so far as the effects of Prâṇâyâma on them are concerned The stomach, the pancreas and the liver which play a very prominent part in digestion and assimilation of food and drink, are all exercised in Prâṇâyâma, for the massage given to them by the diaphragm and the abdominal muscles. In a very large number of people who are dyspeptic and constipated, the liver becomes habitually congested and consequently faulty in function. For relieving this congestion Prâṇâyâma is an excellent exercise. An unhealthy pancreas gets very good stimulus and correction for Pranayamic exercises. In our clinical experience we have noticed a number of cases being effectively relieved of their gastric disorders, mainly as the result of Prâṇâyâma.

With a perfectly functioning digestive system, assimilation also becomes perfect, and the blood is enriched with the necessary nutritive elements.

The oxygen carrying capacity of the blood is of supreme importance for the health of an individual. This capacity can be developed very efficiently by means of Prâṇâyâma. The scope of this handbook does not allow us to enter into physiological details. We refer our readers to the volumes of *Yoga-Mîmâṅsâ* for evidence that conclusively proves the statements that we are presently going to make.

Prâṇâyâma performed according to the technique given in the preceding chapters is capable of improving the oxygen-carrying capacity of the blood as no other exercise is. This is not because during the process of Prâṇâyâma an individual absorbs a larger quantity of oxygen, but because of the training of the respiratory system which helps the individual for twenty-four hours. The impression that an individual absorbs larger quantities of oxygen in Prâṇâyâma is merely a superstition. We shall explain how. Any Prâṇâyâma worth the name should have every round of it to cover one minute. Now an average person inhales in one minute about 7,000 c.c. of air during normal inspiration. The same individual during Prâṇâyâma will inhale at the most 3,700 c.c. in one minute. The total intake of air being far smaller in Prâṇâyâma the absorption of oxygen is consequently smaller. We have conclusively proved in *Yoga-Mîmâṅsâ* on the strength of experimental evidence that the degree of absorption of oxygen does not vary in proportion to the time for which breath is retained. For this reason even when breath is held even for half a minute, the increase in the absorption of oxygen over

the normal absorption is not considerable. Thus it will be clear that the idea that an individual absorbs larger quantities of oxygen during Prâṇâyâma is a myth.

Where then is the advantage of practising Prâṇâyâma for enriching the blood with oxygen? The answer to this question is as follows. Even when temporarily during the process of Prâṇâyâma an individual absorbs smaller quantities of oxygen, the Pranayamic exercises so train the respiratory apparatus that during the remaining part of the day respiration is carried on most efficiently and larger quantities of oxygen are absorbed throughout the day, than they ordinarily would be.

In the chapter on Ujjâyî we have recommended four rounds of it in a minute. This recommendation is for people who practise only Rechaka and Pûraka. For ordinary purposes of physical culture this is sufficient. It is to be noted that when four rounds of Ujjâyi are performed in a minute the quantity of oxygen absorbed even during the Pranayamic process is much larger than in ordinary respiration. The training of the respiratory apparatus by means of having four rounds of Ujjâyî in a minute is sufficient for all practical purposes of physical culture.

With the efficient functioning of the organs of digestion, elimination and respiration, the quality of the blood remains satisfactory. Now this blood is to be distributed to the different tissues of the body. This is the duty of the circulatory system and especially of the heart. It has been admitted even by the Western scientists that practices in deep breathing exercise a gentle massage on the heart. We have carefully

studied the pressure changes that are produced roundabout the heart in Prâṇâyâma. And we are happy to note that the technique of Prâṇâyâma as it is given in Yoga, establishes conditions much more favourable for this massage, than the conditions secured in the Western type of deep breathing. For the elucidation of this point we again refer our readers to the volumes of *Yoga-Mimâṅsâ*. Now the heart which is the principal organ of circulation being made healthier for Prâṇâyâma, the whole circulatory system works satisfactorily.

But the matter does not end there. In Bhastrikâ, especially for its part which corresponds to Kapâlabhâti, vibrations start and spread themselves to nearly every tissue in the human organism, the arteries, the veins and the capillaries included. Thus the whole circulatory system is exercised and massaged during Prâṇâyâma and is prepared for efficient functioning.

Next we come to the nervous and the glandular systems. The rich quality of the blood and its satisfactory distribution to all the nerves and glands ensure their health. During Prâṇâyâma especially during Bhastrikâ, the circulation of the blood becomes very rapid and the quality of the blood is also rendered very rich. (Evidence on this point has already been collected in our laboratory and will in due course of time, appear in *Yoga-Mimâṅsâ*). This richer and more liberal blood supply brought to the endocrine glands makes them healthier. The same is the case with the brain, the spinal cord, the cranial and the spinal nerves and the sympathetic.

The advantage derived from a richer and more liberal blood supply is not the only advantage the nervous system gets from Prâṇâyâma. The nerves are directly exercised. During Pûraka the diaphragm is contracted and lowered and

the abdominal muscles are kept controlled, that is, slightly contracted. The combined action of the diaphragm and the abdominal muscles pulls up the lower part of the spinal column. If Jâlandhara-Bandha is practised the upper part of the spinal column is also pulled up. This pulling up of the vertebral column as a whole, gives exercise to the sympathetic and the roots of the spinal nerves.

Limitations of this handbook do not allow us even to make a passing reference to the exercise of the brain by the Pranayamic processes. Suffice it to say that the whole nervous system is very finely exercised by the practice of Prâṇâyâma. Thus the nervous and the glandular systems which are of supreme importance in human physiology and also the respiratory, the circulatory and the digestive systems upon which the health of the first two systems depends, are all simultaneously exercised in Prâṇâyâma. Every round either of Ujjâyî or Bhastrikâ makes the organism healthier. In fact the Yogic seers of ancient India looked upon Prâṇâyâma as the one exercise that could make every life process supremely healthy. Some of them were so enthusiastic in their optimism about the physiological efficiency of Prâṇâyâma that they ruled out all other exercises for securing the health of human body. From our own experience we can safely say that no physical exercise can even have one hundredth of the efficacy of Prâṇâyâma. In fact Prâṇâyâma is not only the control of the different physiological functions but it is the control of the very life processes that vitalize the human organism.

The spiritual value of Prâṇâyâma is none the less inferior. People fail to understand how a physical process could lead to

spiritual development. To-day we have not got sufficient *laboratory* evidence to convince those that are prejudiced against Yoga. But we can surely offer a few remarks on this point which will appeal to people who have an impartial but sympathetic attitude towards Yoga. Students of endocrinology are coming to the conclusion that the endocrine glands are capable of influencing not only the physiology but also the psychology of an individual. The most optimistic of them feel that they could change criminals into saints by means of treating endocrine glands. There is yet time for this optimism to be universal. Orthodox scientists need not accept everything that endocrinology has to say. But even they cannot deny the fact that the endocrine glands materially influence the psychology of a person.

Hypothetically we are satisfied that particular nerve centres have got influence on human psychology similar to the influence of the glands of internal secretion. That these centres of the human nervous system could be effectively worked upon and made to experience extraordinary impulses and vibrations, is a fact of every day experience for practical students of Yoga. It is our fond hope that a day will arise when these impulses and vibrations could be demonstrated objectively in the laboratory of the *Kaivalyadhâma* and their influence on human psychology could be scientifically established. The day may come when it will. To-day we will explain how the different centres are worked upon through the physiology of Prâṇâyâma. As the scope of this handbook does not allow us to enter into details, we will give here merely a broad outline of our explanation.

A reference has already been made to the pulling up of the spinal column in Prâṇayâma. By means of different

Bandhas introduced in the technique of Prâṇâyâma, that pull is made to exercise very considerable tension upon the spine from the bottom to the highest point of it. This tension gives strong peripheral stimulus to the whole nervous system.

In *Yoga-Mîmâṅsâ* we have discussed the intra-thoracic and intra-pulmonic pressure changes in Prâṇâyâma. The intra-abdominal pressures also undergo considerable changes in Pranayamic exercises. It can be easily proved that all the three types of pressures referred to just now, are rendered extremely high during Prâṇâyâma practised with the three Bandhas, Mûla, Uḍḍiyâna and Jâlandhara. This high pressure gives peripheral stimulus to the different nerve plexuses situated in the abdomen and the thorax.

Again we are hypothetically satisfied that the practice of Prâṇâyâma introduces high pressures both in the central canal of the spinal cord and the ventricles of the brain. These pressures centrally stimulate the whole nervous system. Owing to those central and peripheral stimuli, the human consciousness begins to be internalized and supersensuous perceptions begin to be possible. Worlds subtler and still subtler begin to be opened out in proportion to the consciousness itself getting more and more refined, till at last the individual consciousness merges into the cosmic and the individual becomes one with the Infinite.

APPENDICES

I

A FULL COURSE IN YOGIC PHYSICAL CULTURE

FOR AN AVERAGE MAN OF HEALTH

ÂSANAS

1	Śirshâsana	1/4 min. to 12 mins., adding 1/2 min. per week.
2	Sarvâṅgâsana	1/2 min. to 6 mins., adding 1 min. per week.
3	Matsyâsana	1/4 min. to 3 mins., adding 1/4 min. per week.
4	Halâsana	1 min. to 4 mins., adding 1 min. per week.
5	Bhujaṅgâsana	3 to 7 times each ; the pose being maintained for 10 seconds, adding one turn every fortnight to each.
6	Śalabhâsana	
7	Dhanurâsana	
8	Ardha-Matsyendrâsana . .	1/4 min. to 1 min., adding 1/4 min. per week.
9	Paśchimatâna	1/4 min. to 1 min., adding 1/4 min. per week.
10	Mayûrâsana	1/6 min. to 2 mins., adding 1/4 min. per week.
11	Śavâsana	2 mins. to 10 mins., adding 2 mins. per week.

BANDHA

1 Uḍḍiyâna	3 to 7 turns, adding 1 turn per week.

MUDRÂ

1 Yoga-Mudrâ	1 min. to 3 mins., adding 1 min. per week.

KRIYÂS

1 Nauli	3 to 7 turns, adding 1 turn per week.
2 Kapâlabhâti	3 rounds of 11 to 121 expulsions each, adding 11 expulsions to each round every week.

PRÂṆÂYÂMAS

1 Ujjâyî	7 to 28 rounds, adding 3 rounds every week.
2 Bhastrikâ	3 rounds of 11 to 121 expulsions each, adding 11 expulsions to each round every week. Every round to be followed by a suitable Kumbhaka.

A FEW HINTS REGARDING THE FULL COURSE

LIMITATIONS

1 Students of Yogic physical culture will do well to remember the following limitations that have been indicated from time to time in *Yoga-Mîmâṁsâ* for each exercise; and which have been summarized here in the following section.

2 People suffering from running ears, weak eye capillaries, and weak heart should avoid the practice of Śīrshâsana. This, Viparīta Karaṇī and Sarvâṅgâsana may be very *cautiously* practised by those that are troubled by chronic nasal catarrh. Bhujaṅgâsana, Śalabhâsana and Dhanurâsana are to be avoided by persons with considerable tenderness in the abdominal viscera, especially when the spleen is excessively enlarged. Constipated people will be well advised not to practise Yoga-Mudrâ and Paśchimatâna on a large measure. Generally speaking weakness in the heart should exclude the exercises of Uḍḍiyâna, Nauli, Bhastrikâ and Kapâlabhâti. Weakness in the lungs also indicates the exclusion of Kapâlabhâti as well as Bhastrikâ and Ujjâyī Kumbhakas, although the Rechaka and Pûraka of Ujjâyī are available even to people with weak lungs. Persons recording blood pressure above 150 and below 100 mm. Hg. habitually, should exclude the Yogic exercises altogether, provided they are going to undertake these exercises on their own responsibility.

N. B.— Any one suffering from considerable weakness in any part of the body will do well to consult an expert for giving him the necessary exercises.

MEASURE

3 The course is perfectly general. The proportion of time shown against each exercise is also general and has no reference to individual cases.

4 Students may stop short with only half the maximum time put down for each exercise, provided that they observe the relative proportion among the different practices.

5 In section 6 another alternative is shown.

6 The maximum to be reached in the different exercises in the FULL COURSE, may also be as follows: Śîrshâsana. 6 mins.; Sarvâṅgâsana, 3 mins.; Matsyâsana, 1 min.; Halâsana, 2 mins.; Bhujaṅgâsana, Śalabhâsana and Dhanurâsana, 3 mins. each; Ardha-Matsyendrâsana, Paśchimatâna and Mayûrâsana, 1 min. each; Uḍḍiyâna, 2 mins.; Yoga-Mudrâ, 1 min.; Nauli, 3 mins.. Kapâlabhâti or Bhastrikâ 8 mins. and Ujjâyî, 7 mins.

7 People who want to reduce their time of exercise to the lowest possible minimum, should take up the SHORT COURSE.

CAUTION

8 Under no circumstances should the exercises lead to languor. The student should come out of his practices fully refreshed, a sort of quiet settling over his nerves.

9 The whole course need not be gone through at a stretch. It may be profitably punctuated with convenient periods of rest.

10 Even then care should be taken to see that the total amount of energy expended does not strain the system.

11 *Be with caution bold* is our repeated advice to the students of Yogic physical culture.

12 If there is a considerable break in the practice of these exercises, whenever the exercises are to be started again, they should start on a humbler scale, although the full measure may be reached somewhat rapidly.

13 After severe illness the Yogic exercises should be undertaken only when the patient recovers sufficient energy for their practice. It would always be desirable, by way of a cautious measure, to prefix to the practice of these exercises, a moderately long walk everyday for a week or so.

14 But the Yogic exercises should never commence for an hour and a half after even a moderate quantity of solid food or a good quantity of liquid food. Half a cup of liquid would allow the exercises to be started in half an hour. At least four hours and a half must elapse between a heavy meal and the Yogic exercises. In short, the Yogic exercises should always begin with a light stomach.

15 There is no harm if food is taken in a moderate quantity in something like half an hour after the Yogic exercises.

TIME AND SEQUENCE

16 Uḍḍiyâna, Nauli, Kapâlabhâti or Bhastrikâ and Ujjâyi should be practised in the morning, in the sequence in which they have been taken up here.

17 Uḍḍiyâna and Nauli may be practised by the constipated people even before they get the call of nature.

18 Taking a few ounces, say ten to twenty, of tepid water, with a little rock-salt added to it (1 grain per ounce), may be taken before practising Nauli. This will induce a rapid bowel movement.

19 Kapâlabhâti or Bhastrikâ and Ujjâyi should follow not only evacuation, but, as far as possible, a full bath. They are best practised in Padmâsana or Siddhâsana although for Kapâlabhâti and Bhastrikâ, Padmâsana is preferable.

20 Âsanas are better gone through in the evening, because muscles are more elastic then than in the morning.

21 Yoga-Mudrâ so also Ujjâyî and Kapâlabhâti or Bhastrikâ may be practised also in the evening.

22 Yoga-Mudrâ should be taken up with Âsanas and be practised before Śavâsana.

23 Whether in the morning or in the evening, the Yogic exercises should be practised in the following order. First take Âsanas with Yoga-Mudrâ, then the Bandha and the Kriyâs, and lastly the Prâṇâyâmas. Kapâlabhâti should be considered as a part of Prâṇâyâma.

24 In practising Âsanas students will do well to preserve the sequence of the various poses that has been followed in enlisting them here. In getting oneself trained, however, one need not follow this sequence rigorously. One may pick up the different Âsanas in any order he likes, the easiest being taken up first and the more difficult being taken up later on

25 The omission of a particular practice does not disqualify a student to go through the remaining part of the scheme with advantage.

COMBINATION WITH OTHER EXERCISES

26 There is no harm in undergoing the Yogic exercises and strenuous muscular exercises side by side.

27 But the two should never be practised immediately before one another. At least a period of twenty minutes should be allowed to go by.

28 Those that want to finish their exercises with a balance introduced into their system, should take the Yogic exercises last. But those that want to have a spirit of exhilaration at the end, should finish with the muscular exercises.

29 Walk when taken as an exercise must be brisk, and for considerations of sequence should be treated as a muscular exercise. A stroll stands on a different level, and may precede or follow the Yogic practices.

YOGIC EXERCISES AND BATH

30 A whole bath should precede the Yogic exercises. Because the same promotes blood circulation uniformly throughout the body, and the diversion of a richer blood current to a particular part by means of a Yogic exercise becomes easier.

31 But a local bath intended for a particular part of the body for promoting blood circulation therein, should neither precede nor follow the *general* Yogic exercises immediately, although local baths and the particular Yogic exercises may be combined with the advice of an expert.

FOOD, DRINK AND SMOKE

32 Every man should try to find which food suits him the best, irrespective of the dictates of his palate.

33 Even people who maintain more than average health, should restrict themselves to such varieties of food as they find agreeable. Every meal should be of a moderate quantity which must be well masticated, so that it may become freely mixed with the saliva and its digestion may become easier.

34 People with weak digestion should take to low protein diet. They should satisfy themselves with two meals per day

and preferably even with one, the place of the other meal being taken by light refreshment.

35 Those who suffer from dyspepsia and constipation or have some uric acid trouble, will do well to eliminate all sorts of pulse. They should also avoid potatoes, brinjals and onions.

36 Water taken half an hour after the meal suits almost every constitution. Those that have their digestive capacity unimpaired may take water along with their food.

37 All alcoholic drinks are to be cautiously avoided Stimulants such as tea and coffee are never to be taken in excess and may preferably be eliminated altogether. For a man that cares for his health, there cannot be a more luxurious drink than plain water.

38 Heavy smoking of whatever sort invariably shatters the nerves, if carried on across many years Weak nerves, persistent cough, sore throat etc., always harass a heavy smoker : and may often beset the path even of a light smoker.

EXERCISES FOR FEMALES

39 The FULL COURSE is available to females as well as to males.

40 In the case of females it is desirable to suspend all the Yogic exercises during the monthly illness and pregnancy.

EXERCISES FOR BOYS AND GIRLS

41 Boys and girls will do well, first to start with the SHORT COURSE in every case and to take up the FULL COURSE later on.

42 Boys and girls under 12 would be well advised to restrict themselves to Bhujaṅgâsana, Ardha-Śalabhâsana, Dhanurâsana, Paśchimatâna, Halâsana and Yoga-Mudrâ only. After 12 the remaining exercises of the FULL COURSE may be taken up.

N. B.— This FULL COURSE and the hints given thereon are intended for an average man of health. People falling below the average may try the SHORT COURSE, or better seek expert advice, for being prescribed suitable exercises.

II

A SHORT COURSE IN YOGIC PHYSICAL CULTURE

Pose		Instructions
1 Bhujañgâsana	... ...	3 to 7 turns each; the pose being maintained for 2 to 5 seconds, one turn being added to each, every fortnight.
2 Ardha-Śalabhâsana	...	
3 Dhanurâsana	... ...	
4 Halâsana	... ...	First only Ardha-Halâsana to be tried for 2 seconds in each of its stages. Then the full pose may be taken through its four different stages, each stage being maintained for 2 seconds only. 3 to 5 turns, adding one turn every fortnight.
5 Paśchimatâna	... ...	To be maintained for 5 seconds. 3 to 7 turns, adding one turn every fortnight.
6 Ardha-Matsyendrâsana	...	To be maintained for 5 seconds. 3 to 7 turns, adding one turn every fortnight.

7 Yoga-Mudrâ or Uḍḍiyâna	To be maintained for 10 seconds. 3 to 5 turns, adding one turn per week.
8 Viparîta Karaṇî	First Ardha to be practised with 2 seconds' pause at every stage. Afterwards the full pose to be taken with 10 seconds' pause. 2 to 5 turns, adding one turn every fortnight.
9 Ujjâyî	7 to 21 rounds, adding 3 rounds per week.

HINTS REGARDING THE SHORT COURSE

1 This SHORT COURSE is framed for those people who cannot for want of time, strength or wish, follow the FULL COURSE.

2 All the hints given to Yogic physical culturists concerning the FULL COURSE should be applicable to this SHORT COURSE also.

3 Exercises tabulated here may be started at the age of 9. Ujjâyî and Uḍḍiyâna should not be begun, however, before 12 or even 13.

4 This SHORT COURSE is available to females as well as to males.

5 Those that can tolerate the Yogic exercises in the morning, may, if they so choose, undergo this SHORT COURSE both morning and evening. Others should practise Ujjâyî and Uḍḍiyâna in the morning and the rest of the exercises in the evening. Ujjâyî is to be practised in the evening also.

6 This SHORT COURSE may be made shorter not by omitting any of the practices tabled here, but by undergoing all the exercises on a smaller scale.

7 Although the practice of this SHORT COURSE is comparatively innocent, people suffering from any serious disorder should not undertake exercises on their own responsibility.

GLOSSARY

[*N.B.*—References to pages refer to the body of this handbook. Greek or Latin origin of words is given in the glossary. Saṅskṛita origin being given in the body of the handbook is omitted from here.]

(Grk.–Greek: Lat.–Latin; Skr.–Saṅskṛita.)

ABDOMEN, the belly.

ABDOMINAL BREATHING, that type of respiration in which the abdominal movement is prominent. (Vide p. 23).

ÂBHYANTARA (Skr.), internal: coming after inhalation. (Vide p. 48).

ADAM'S APPLE, popular name of the thyroid cartilage.

ALVEOLUS, pl. alveoli, a small cavity; an air-cell of the lung.

ANUS, the terminal opening of the rectum.

APEX OF THE NOSE, the free end of the nose.

APNŒA, (Grk. *a*, not, and *pneō*, I breathe), transient cessation of respiration. (Vide p. 48).

ARTERIALIZATION, the process of turning the venous into arterial blood.

ARTERY, adj. arterial, one of the tubes through which the heart propels the blood to the different parts of the body.

ÂSANA (Skr.), a Yogic pose.

ATMOSPHERIC PRESSURE, pressure equal to that of a column of mercury about 30 inches or 760 mm. in height.

AUDITORY (Lat. *audio*, I hear), of the organ or sense of hearing.

AUDITORY TUBES, see Eustachian tubes.

ÂYÂMA (Skr.), a control. (Vide p. 45).

BÂHYA (Skr.), external; coming after exhalation. (Vide p. 48).

BANDHA (Skr.), a fixed arrangement of contracted muscles. (Vide p. 33).

BASTI (Skr.), the Yogic method of flushing the colon.

BHASTRÂ (Skr.), the bellows.

BHASTRIKÂ (Skr.), a variety of Prâṇâyâma. See Chapter VI.

BHRÂMARÎ (Skr.), one of the eight varieties of Prâṇâyâma wherein a student of Yoga imitates the humming of bees during inhalations and exhalations.

BHRÛMADHYA-DṚISHṬI (Skr.), the Frontal Gaze. This requires fixing one's eyes between the eyebrows. (Vide p. 31).

BLOOD-VESSEL, a flexible tube such as an artery or a vein that conveys blood.

BRAHMÂNANDA, a commentator of Haṭha-Pradîpikâ.

BREASTBONE, the thin flat vertical bone in the chest connecting the ribs in the front.

BRIDGE OF THE NOSE, the structure formed by the two nasal bones.

BRONCHUS (Grk. *bronchos*), pl. bronchi, one of the two branches into which the windpipe bifurcates in the chest.

CAPILLARY, a minute blood-vessel connecting the smallest ramifications of the arteries with those of the veins.

CARDIAC (Grk. *kardia*, the heart), of the heart.

CARTILAGE (Lat. *cartilago*), gristle; a firm but elastic anatomical structure such as that forming the external ear or nose.

CENTRAL (STIMULUS), given to the internal surface.

CENTRAL CANAL, the small canal that extends throughout the centre of the spinal cord.

CENTRAL NERVOUS SYSTEM, see nervous system.

CERVICAL VERTEBRÆ, see vertebra.

CHAKRA (Skr.), a nerve-centre of spiritual significance. (Vide pp. 55 and 96).

CHANDRA-NÂḌÎ (Skr.), Iḍâ; the left nostril. (Vide p. 60).

CILIA, minute hair-like vibrating organs on the surface of the epithelium, forming there a sort of brush.

CILIATED EPITHELIUM, see cilia and epithelium.

CIRCULATORY SYSTEM, the system consisting of organs responsible for the circulation of the blood; they are the heart, the arteries, the veins and the capillaries.

CLAVICLE, the collar-bone.

COCCYGEAL, n. coccyx, of the coccyx. See vertebra.

COMPLEMENTAL AIR, the difference in quantity of air inhaled in the normal and the deepest inspiration. (Vide p. 25).

CONGESTION, an abnormal accumulation of the blood in a part of the body.

COSTAL BREATHING, that type of respiration in which the movement of the ribs is prominent. (Vide p. 23).

CRANIAL NERVES, see nerves.

CRICOID CARTILAGE, a prominent cartilage forming the larynx. (Vide p. 11).

DHAUTI (Skr.), the Yogic method of cleansing and massaging the stomach.

DIAPHRAGM (Grk. *diaphragma*, a partition), the big muscle that forms the floor of the thorax separating it from the abdomen.

DIAPHRAGMATIC BREATHING, the same as the abdominal breathing.

DIGESTIVE SYSTEM, this consists of the organs of digestion, such as the stomach, the small intestine, etc.

DṚISHṬI (Skr.), a gaze.

ENDOCRINE GLANDS (Grk. *endon*, within, and *krino*, I separate out), glands which produce an internal secretion.

ENDOCRINOLOGY, the study of the endocrine glands.

EPIGLOTTIS (Grk. *epi*, upon, and *glottis*, the upper opening of the windpipe), the erect cartilage situated at the root of the tongue. It is depressed during the action of swallowing to cover the glottis and thus to prevent food going a wrong way. (Vide p. 10).

EPITHELIUM, a delicate tissue forming the outer layer of the mucous membrane.

ETHMOID, the big bone which forms a part of the nasal roof. (Vide p. 5).

EUSTACHIAN ORIFICES, the pharyngeal openings of the auditory tubes. (Vide p. 9).

EUSTACHIAN TUBES, canals connecting the pharynx with the cavities of the ears: the auditory tubes. The pharyngeal openings of these tubes are called the Eustachian orifices.

FLEXORS, muscles that bend the different parts of the body, such as the legs, the thighs, etc.

GANGLIATED CORDS, nervous chains furnished with ganglia.

GANGLION, pl. ganglia, a well-defined collection of nerve cells and fibres forming a subordinate nerve-centre.

GHERANḌA-SAṀHITÂ (Skr.), a text-book of Haṭha-Yoga.

GLOTTIS (Grk.), an opening between the vocal cords situated in the windpipe. (Vide p. 13).

GROIN, the depression between the belly and the thigh.

GUPTÂSANA (Skr.), the same as Samâsana. (Vide p. 43).

HARD PALATE, the hard part of the roof of the mouth.

HAṬHA (Skr.), Haṭha-Yoga; that system of Yoga which starts with the purification of the body as the first step towards spiritual perfection.

HAṬHA-PRADÎPIKÂ (Skr.), the most authoritative text of Haṭha-Yoga.

HEART, the muscular pump situated in the chest that keeps up the blood circulating in the body.

IḌÂ (Skr.), Chandra-Nâḍi; the left nostril. (Vide p. 60).

ILIAC BONES, the two side bones in the lower portion of the abdomen.

INTERCOSTAL (Lat. *inter*, between, and *costa*, a rib), situated between the ribs.

INTERNALIZE, turn inward.

INTRA-ABDOMINAL, inside the abdomen.

INTRA-PULMONIC, inside the lungs.

INTRA-THORACIC, inside the thorax.

JÂLANDHARA-BANDHA (Skr.), the Chin-Lock, requiring the chin to be closely pressed against the chest. (Vide p. 34).

JN'ÂNA-MUDRÂ (Skr.), the Symbol of Knowledge. (Vide p. 64).

JUGULAR NOTCH (Lat. *jugulum*, the throat), the depression below the throat and between the two collar-bones.

KAPÂLABHÂTI (Skr.), one of the Shat Kriyâs consisting of a breathing exercise for the purification of the body. See Chapter V.

KEVALA (Skr.), pure; without inhalation or exhalation. (Vide p. 48).

KIDNEYS, the two abdominal organs which are mainly concerned in the excretion of urine.

KRIYÂ (Skr.), any Yogic exercise, especially any of the six cleansing processes.

KUMBHAKA (Skr.), see Prâṇâyâma.

KUṆḌALINÎ (Skr.), the spiritual energy ordinarily locked up in an abdominal centre. (Vide pp. 33 and 96).

KUŚA (Skr.), a kind of sacred grass.

LARYNX, (Grk.), adj. laryngeal, the cavity forming the voice-box situated in the throat below the pharynx. (Vide p. 11).

LIVER, a large glandular organ that manufactures bile and purifies the venous blood.

LUNG CAPACITY, this is indicated by the vital capacity plus 1600 c.c. of air. (Vide p. 26).

LUNGS, the breathing organs situated in the chest. (Vide p. 16).

MÂTRÂ (Skr.), a time-unit. (Vide p. 51).

MEDIASTINAL CAVITY, (Lat. *medius*, middle), the cavity that separates the two lungs. (Vide p. 19).

MEMBRANE, pliable sheet-like lining in the human body

MOTOR NERVES, nerves responsible for the muscular activity. Also see nerves.

MUCOUS MEMBRANE, a membrane secreting a slimmy substance called mucous, such as covers our lips.

MUDRÂ (Skr.), a symbol

MÛLA-BANDHA (Skr.), the Anal Contraction which requires vigorous contraction of the sphincters of the anus. (Vide p. 35).

MURCHCHHÂ or MURCHCHHANÂ (Skr.), one of the eight varieties of Prâṇâyâma which is peculiarly capable of rendering the mind passive. (Vide p. 83).

MUSCLE, any of the contractile fibrous bundles that chiefly constitute flesh. Muscles are of two kinds, the striped or striated and the smooth or unstriated. The striped muscles are voluntary and the smooth are involuntary. Involuntary muscles are not subject to the will.

NÂḌÎ (Skr.), a nerve; a nostril.

NÂḌÎŚUDDHI (Skr.), physiological balance necessary for spiritual development. (Vide p. 97).

NÂSÂGRA-DRISHTI (Skr.), the Nasal Gaze. This requires fixing one's eyes upon one's tip of the nose. (Vide p. 30).

NASAL BONES, the two bones of the nose standing between the eyes and below the forehead. (Vide p. 3).

NAULI or NAULIKA, one of the Shat Kriyâs, being an abdominal exercise consisting of the rolling manipulations of the isolated recti.

NERVES, fine thread-like or wire-like structures connecting the brain and the spinal cord with the different parts of the body. Messages running to and fro across these wires are responsible for different sensations experienced by man and the various movements he makes. The nerves responsible for the muscular activity are called the motor nerves, whereas those that convey sensations from the ends to the different centres are called the sensory nerves. System consisting of these wire-like structures together with the brain and the spinal cord, manages all the voluntary and involuntary functions of the human body.

NERVOUS SYSTEM, see nerves. All the nerves put together, form the nervous system. It consists of two divisions, the central or cerebro-spinal system and the autonomic system. The latter is subdivided into two parts, the parasympathetic and the sympathetic. The central nervous system mainly consists of the brain, 12 pairs of the cranial nerves, the spinal cord and 31 pairs of the spinal nerves. The sympathetic is chiefly represented by two chains of ganglia placed one on each side of the spinal column. The parasympathetic is found near the brain and the sacrum.

NETI (Skr.), one of the Shat Kriyâs for cleansing the nasal passage by means of a wick inserted through the nose and extracted through the mouth.

NOSTRILS, the two openings in the nose.

ŒSOPHAGUS, the canal extending from the throat to the stomach, some 9 to 10 inches in length, through which food and drink pass; the gullet.

OLFACTORY BULB, the bulbous end of the olfactory nerve.

OLFACTORY NERVES (Lat. *oleo*, I smell, and *facio*, I make), nerves responsible for the sense of smell.

OLFACTORY REGION, the upper third of the nasal cavities which contains the sense of smell. (Vide p. 6).

OPTIC NERVES, nerves responsible for the sense of sight.

PADMÂSANA (Skr.), the Lotus Pose. (Vide p. 36).

PANCREAS, a gland that is situated near the stomach and that provides a digestive secretion to the system.

PARASYMPATHETIC NERVOUS SYSTEM, see nervous system.

PARIETAL (Lat. *paries*, a wall), of the wall of the body or of any of its cavities. Thus the parietal layer of the pleura is the layer which lines the inner surface of the thoracic cavities. (Vide p. 18).

PATAN'JALI, the author of Yoga Sûtras. The first systematic exponent of Yoga philosophy.

PELVIS, adj. pelvic, the lowermost part of the abdominal cavity between the hip-bones.

PERINEUM, the portion between the genitals and the anus.

PERIPHERAL (STIMULUS), given to the external surface.

PHARYNX (Gr.), adj. pharyngeal, cavity with enclosing muscles and mucous membrane situated behind the nose, mouth and larynx. This cavity has openings which individually communicate with each of these organs. (Vide p. 8).

PIÑGALÂ (Skr.). Sûrya-Nâḍî ; the right nostril. (Vide p. 60).

PITUITARY, a ductless gland situated in the upper region of the central nervous system.

PLÂVINÎ (Skr.), one of the eight varieties of Prâṇâyâma which enables one to float on water very comfortably.

PLEURA, pl. pleuræ, one of the two serous membranes lining the thorax and enveloping the lungs.

PLEURAL CAVITY, the space between the two layers of the pleuræ. (Vide p. 19).

PLEXUS (Lat., a network), a tangle of nerves and blood-vessels.

PNEUMOGASTRIC NERVE, the vagus nerve. It is the most extensive of the cranial nerves distributed to the lungs, the heart, the stomach, etc, and is notably responsible for the movements of the respiratory muscles.

PRACHCHHARDANA (Skr.), Rechaka. (Vide p. 50).

PRÂṆA (Skr.) a breath. (Vide p. 45).

PRÂṆÂYÂMA (Skr), adj. Pranayamic, the fourth item of Yogic curriculum. Yogic breath control. Kumbhaka. (Vide p. 45). According to Svâtmârâma Sûri there are eight varieties of Prâṇâyâma. They are: Sûryabhedana, Ujjâyî, Sitkârî, Śitali Bhastrikâ, Bhrâmarî, Mûrchchhâ and Plâvinî. (Vide p. 48).

PRAŚVÂSA (Skr.), the air flowing out. (Vide p. 46).

PUBIC BONE, the bone just above the genitals.

PULMONARY (Lat. *pulmo*, a lung), of the lungs.

PÛRAKA (Skr.), inhalation. (Vide p. 49).

RÂJA-YOGA (Skr), Samâdhi. The eighth item of Yogic curriculum.

RECHAKA (Skr.), exhalation. (Vide p. 49).

RECTUM, the last part of the bowel.

RESERVE AIR, the same as supplemental air.

RESIDUAL AIR, that quantity of air which is left in the lungs even after the deepest possible expiration. (Vide p. 25).

RESPIRATION, breathing.

RESPIRATORY CAPACITY, the same as vital capacity.

RESPIRATORY CENTRE, a nerve-centre from which the respiratory activities are governed.

RESPIRATORY REGION, the lower two-thirds of the nasal cavities. (Vide p. 6).

RESPIRATORY SYSTEM, this consists of the organs of respiration, such as the lungs, the trachea, etc. (Vide p. 1).

ROOT OF THE NOSE, the upper end of the nose.

SACRAL, n. sacrum, belonging to the sacrum. See vertebræ.

SÂDHAKA (Skr.), an aspirant trying to evolve himself spiritually.

SAMÂDHI (Skr.), the eighth stage in Yogic evolution wherein the individual either stands face to face with the Infinite or becomes entirely merged into it.

SAMÂSANA (Skr.), the Symmetrical Pose. (Vide p. 43).

SENSORY NERVES, nerves that convey sensations from ends to the centres. Also see nerves.

SEPTUM, partition such as that between the two nostrils.

SEROUS MEMBRANE, a smooth glistening membrane that secretes a lubricating fluid.

SHAT KRIYÂS (Skr.), the six cleansing processes prescribed in Haṭha-Yoga for the purification of the body. They are Dhauti, Basti, Neti, Trâṭaka, Nauli and Kapâlabhâti. (Vide p. 79).

SIDDHÂSANA (Skr.), the Accomplished Pose. (Vide p. 38).

ŚÎTALÎ (Skr.), one of the eight varieties of Prâṇâyâma characterized by oral inhalations wherein the tongue is projected outside the mouth in a beak-like arrangement. Śîtalî has a cooling effect upon the whole system.

SÎTKÂRÎ (Skr.), one of the eight varieties of Prâṇâyâma characterized by a wheezing sound that is produced by a peculiar arrangement of the teeth and the tongue during inspirations.

ŚIVA-SAṀHITÂ (Skr.), a text-book of Haṭha-Yoga.

SOFT PALATE, the soft part of the roof of the mouth.

SPHINCTER, muscular structure which surrounds a tube or an opening and closes the same by its contraction.

SPINAL CORD, the tail of the brain which descends into the vertebral column. Also see nervous system.

SPINAL NERVES, see nervous system.

ŚRÎKṚISHṆA, the eighth incarnation of the Lord.

STERNUM (Lat.), the breastbone.

STIMULUS, pl. stimuli, thing evoking functional reaction.

SUPPLEMENTAL AIR, the difference in quantity of air expelled in the normal and the deepest expiration. (Vide p. 25).

SÛRYABHEDANA (Skr.), one of the eight varieties of Prâṇâyâma characterized by invariable inhalations through Sûrya, that is, the right nostril and exhalations through the opposite one with a pause in between the two.

SÛRYA-NÂḌÎ (Skr.), Piṅgalâ or the right nostril. (Vide p. 60).

SUSHUMNÂ (Skr.), the spinal cord. (Vide p. 59).

SÛTRA (Skr.), an aphorism.

ŚVÂSA (Skr.), the air flowing in. (Vide p. 46).

SVASTIKÂSANA (Skr.), the Auspicious Pose. (Vide p. 40).

SVÂTMÂRÂMA SÛRI, the author of Haṭha-Pradîpikâ, the most authoritative text-book of Hatha-Yoga.

SYMPATHETIC NERVOUS SYSTEM, see nervous system.

THORAX, the chest.

THYROID, a ductless gland situated in the neck.

THYROID CARTILAGE, a prominent cartilage forming the larynx. (Vide p. 12).

TIDAL AIR, the volume of air that constantly and uniformly flows out and flows in in normal respiration. (Vide p. 25).

TRACHEA (Lat.), the principal air passage forming the windpipe. Some four inches in length it starts in the throat and descends into the chest. (Vide p. 13).

TRÂṬAKA, one of the Shat Kriyâs being an exercise in gazing.

UḌḌIYÂNA-BANDHA (Skr.), the raising of the diaphragm. (Vide p. 32).

UJJÂYÎ (Skr.), a variety of Prâṇâyâma. See Chap. IV.

VAGUS NERVE (Lat. *vagus*, wandering), the same as pneumogastric nerve so called because of its wide distribution.

VASCULAR (Lat. *vasculum*, a vessel), richly supplied with vessels such as blood-vessels.

VEIN, adj. venous, one of the tubes which carry the blood from the different parts of the body to the heart.

VENTRICLES, cavities as in the interior of the brain.

VERTEBRA, pl. vertebræ, each of the 33 pieces which form the backbone. The topmost seven are called the cervical, the next twelve the dorsal, the next five the lumbar, the next five the sacral and the last four the coccygeal.

VERTEBRAL COLUMN, the spine.

VESTIBULE OF THE NOSE, the lowest chamber of the internal nose. (Vide p. 3).

VIDHÂRAṆA (Skr.), Kumbhaka. (Vide p. 49).

VISCERA, adj. visceral, the interior organs in the great cavities of the body, especially in the abdomen.

VISCERAL LAYER, the inner layer of the pleura which is adherent to the lungs. (Vide p. 18).

VITAL CAPACITY, the capacity indicated by the largest quantity of air a man can inhale after the deepest possible expiration. (Vide p. 26).

VOCAL CORDS, the laryngeal folds of the mucous membrane which are responsible for the production of voice. (Vide pp. 12–13).

VYÂSA, the first commentator of Patan'jali's Yoga Sûtras.

YOGA (Skr.), adj. Yogic, a system of exercises, physical or mental, which may begin with the purification of the body and which culminate in a stage wherein the individual soul becomes merged into the Infinite.

YOGIC PHYSICAL CULTURE, a systematic training of physiological functions through the exercises prescribed in Yoga.

YOGIC THERAPY or YOGIC THERAPEUTICS, the science and art of healing by means of Yogic exercises.

SYSTEM OF TRANSLITERATION FOLLOWED IN THIS HANDBOOK

ॐ (ओम्) 'aum' pronounce 'au' like 'o' in 'home'.
अ 'a' „ 'a' „ 'u' „ 'but'.

आ	'â'	घ्	'gh'	ध्	'dh'
इ	'i'	ङ्	'ñ'	न्	'n'
ई	'î'	च्	'ch'	प्	'p'
उ	'u'	छ्	'chh'	फ्	'ph'
ऊ	'û'	ज्	'j'	ब्	'b'
ऋ	'ṛi'	झ्	'jh'	भ्	'bh'
ॠ	'ri'	ञ्	'n''	म्	'm'
ऌ	'lṛ'	ट्	'ṭ'	य्	'y'
ए	'e'	ठ्	'ṭh'	र्	'r'
ऐ	'ai'	ड्	'ḍ'	ल्	'l'
ओ	'o'	ढ्	'ḍh'	व्	'v'
औ	'au'	ण्	'ṇ'	श्	's''
क्	'k'	त्	't'	ष्	'sh'
ख्	'kh'	थ्	'th'	स्	's'
ग्	'g'	द्	'd'	ह्	'h'

ळ् 'ḷ' a dento-lingual pronounced with a little rounding of lips.

Nasalized म् as in संयम—ṃ; Nasalized म् as in संभव—m̃;
„ „ „ „ संवाद—m̱; „ „ „ „ संहिता—ṁ;
Nasalized न् as in मीमांसा—ṅ; Visarga—ḥ.

म: